APPENDIX 8

Ecological Assessment

Austar Coal Mine Pty Ltd

Ecological Assessment for Austar Proposed Stage 3 Modification

July 2011

Umwelt
Environmental Consultants

Ecological Assessment for Austar Proposed Stage 3 Modification

Prepared by

Umwelt (Australia) Pty Limited

on behalf of

Austar Coal Mine Pty Ltd

Project Director:	Peter Jamieson		
Project Manager:	Catherine Pepper		
Report No.	2274/R65/V3	Date:	July 2011

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

TABLE OF CONTENTS

FIGURES

PLATES

APPENDICES

1.0 Introduction

1.1 Introduction to Proposal

Austar Coal mine is an underground coal mine located approximately 10 kilometres south of Cessnock in the lower Hunter Valley in NSW (**Figure 1.1**). The mine is an aggregate of the former Ellalong, Pelton, Cessnock No.1 and Bellbird South Collieries and is located in the South Maitland Coalfields. These operations including coal extraction, handling, processing and transport collectively form the Austar Mine Complex.

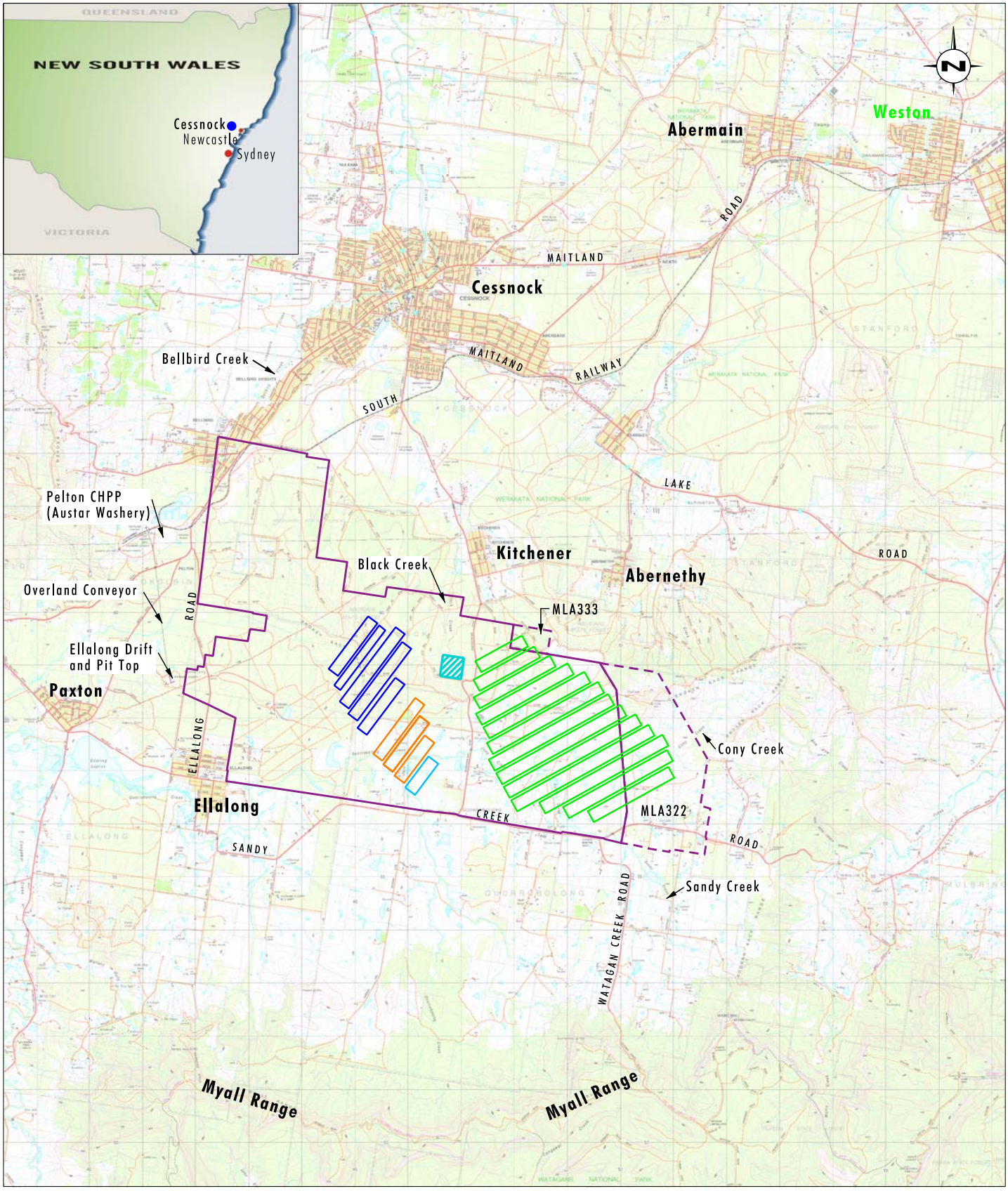
There are three currently approved underground mining areas in the Austar Mine Complex, being Stages 1 through 3. Project Approval 08_0111, being for Stage 3, was granted in September 2009. The approved Stage 3 development consists of underground mining in longwall panels A6 to A17 and the development of a surface infrastructure site (SIS) at Kitchener (**Figure 1.2**). The environmental assessment for the original Stage 3 Mine project, which included a comprehensive ecological assessment, was prepared by Umwelt (Australia) Pty Limited (Umwelt) in 2008.

The subject of this ecological assessment is a proposed modification of Project Approval 08_0111 to allow the Stage 3 longwalls to be reorientated as per **Figure 1.3**. The proposed Stage 3 Modification involves a change to the Stage 3 mine plan only, with no proposed changes to underground mining method, total approved rate or quantity of extraction, or associated surface infrastructure. This ecological assessment does not consider the SIS, as there are no proposed modifications to the SIS approved by Project Approval 08_0111.

The proposed Stage 3 Modification longwall panels (LW A7 to LW A19) are located in Quorrobolong, to the north of Sandy Creek Road and to the east and west of Quorrobolong Road (the majority being to the east of Quorrobolong Road), as shown in **Figure 1.3**. The footprint of the Stage 3 Modification longwalls cover much the same area as the original Stage 3 Mine project (refer to **Figure 1.4**), however there have been some changes to the alignment and length of some of the longwalls, namely the removal of longwall A6, the reorientation of longwalls A7 to A17 and the movement of the main headings to the west (see difference between **Figures 1.2** and **1.3**). It is anticipated that borehole exploration will continue throughout the life of the project for the purposes of refining the mine plan. Section 3 of the environmental assessment provides a more detailed explanation of the changes incorporated into the Stage 3 modification proposal.

Given that the footprints of the original Stage 3 Mine project and proposed Stage 3 Modification areas strongly overlap (refer to **Figure 1.4**), this ecological assessment draws on the outcomes of the extensive surveys undertaken for the original ecological assessment, reported in Umwelt (2008). However, supplementary ecological surveys in some new areas of the Stage 3 Modification footprint have been undertaken. This assessment also provides a comparison of the impacts of the Stage 3 Modification with those of the Stage 3 Mine, reflecting the proposed changes in the mine plan.

This ecological assessment is prepared in accordance with Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and also in accordance with the Director-General's Requirements as set out in Appendix 1 of the environmental assessment. It considers impacts on threatened species, migratory species, endangered populations and threatened ecological communities (TECs), including those listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Fisheries Management Act 1994* (FM Act).



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

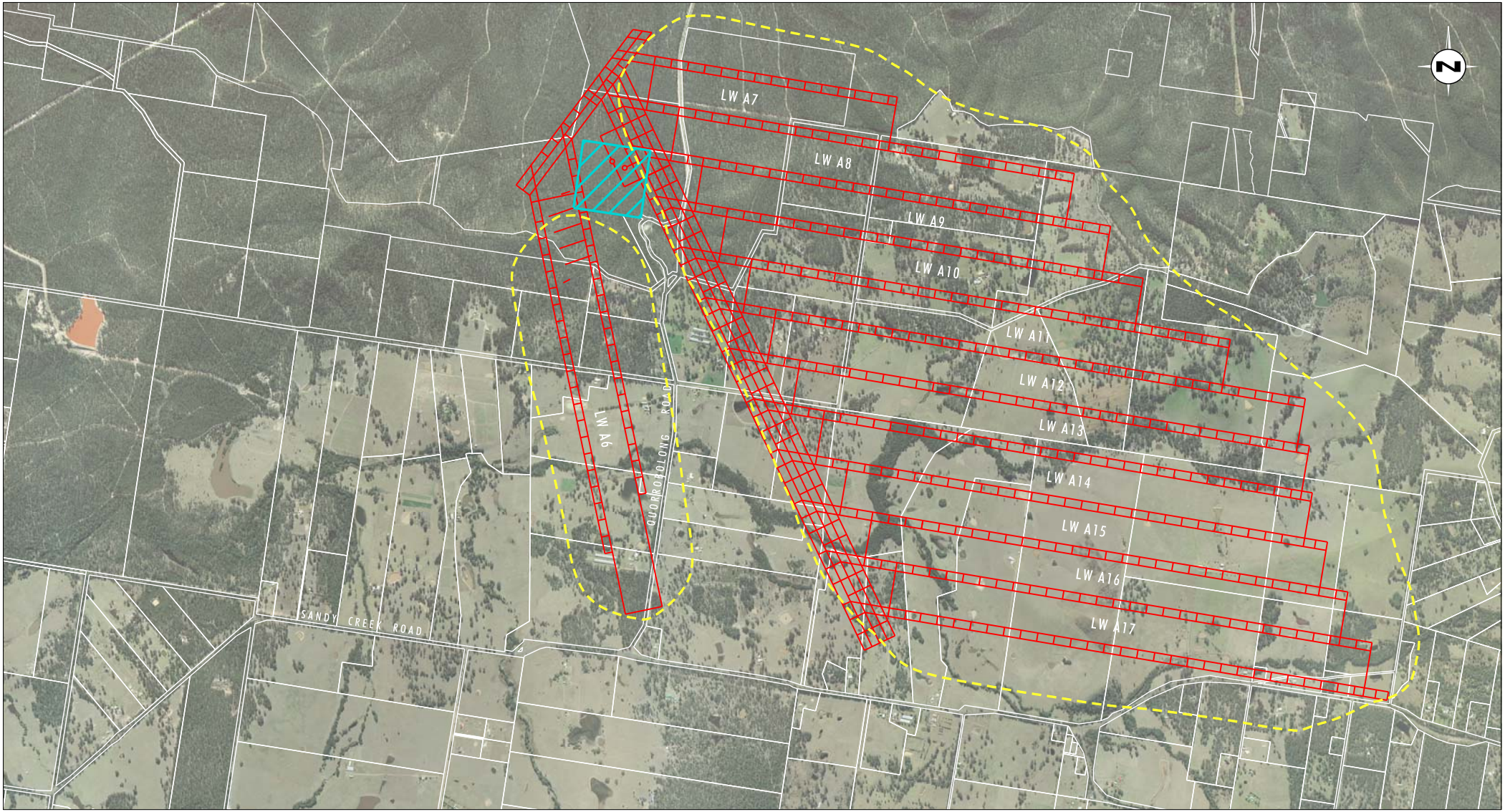
0 1.0 2.0 4km
1:100 000

Legend

- Layout for Stage 1 Longwall Panels
- Layout for Stage 2 Longwall Panels
- Layout for Stage 2 Extension Longwall Panel
- Proposed Stage 3 Modification Longwall Layout
- Approved Surface Infrastructure Site
- Consolidated Mining Lease (CML) 2
- Pending Mining Lease Application Areas

FIGURE 1.1

Austar Mine Complex
Locality Plan



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

0 0.5 1 1.5km
1:32 000

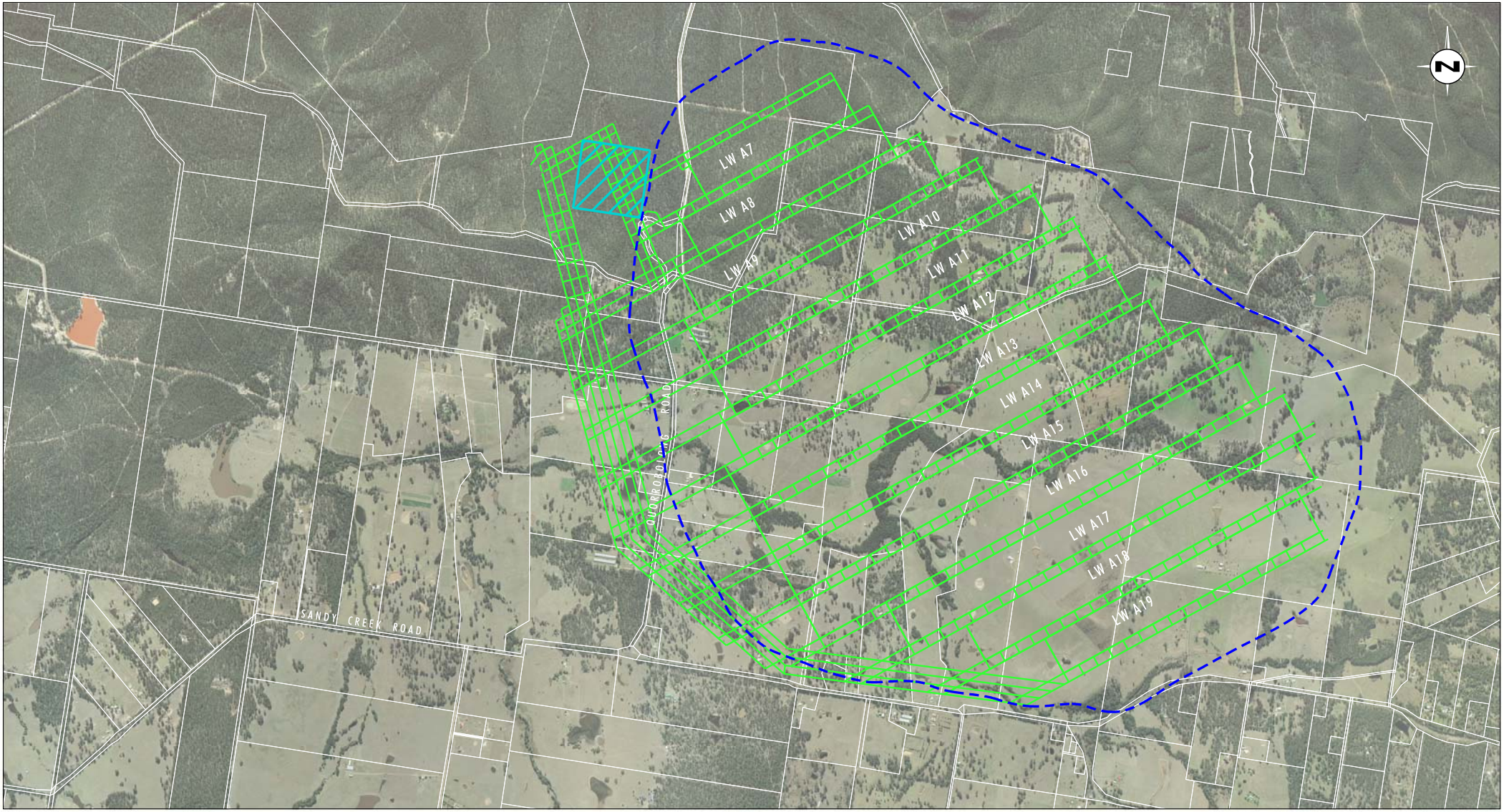
Legend

- Conceptual Layout for Stage 3 Longwall Panels as Approved
- 20mm Subsidence Contour for Conceptual Layout as Approved
- Approved Surface Infrastructure Site

FIGURE 1.2

Approved Stage 3 Mine Plan

File Name (A4): R65_V1/2274_890.dgn



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

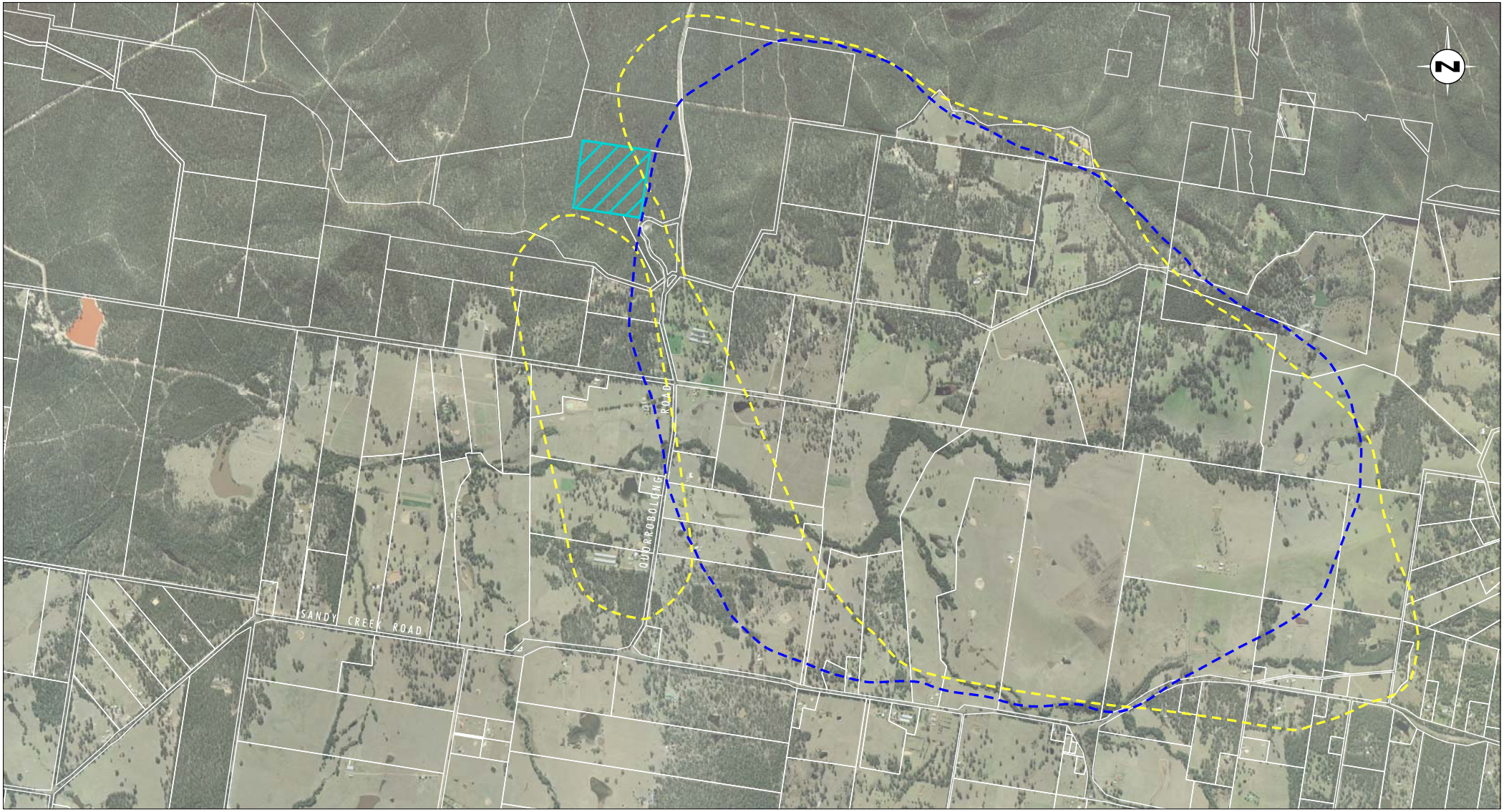
0 0.5 1 1.5km
1:32 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Approved Surface Infrastructure Site

FIGURE 1.3

Proposed Stage 3 Modification Mine Plan



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

0 0.5 1 1.5km
1:32 000

Legend

- 20mm Subsidence Contour for Conceptual Layout as Approved
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Approved Surface Infrastructure Site

FIGURE 1.4

Subsidence Affection Area

1.2 Definitions

For the purposes of this ecological assessment, the following definitions are used:

- **Stage 3 Modification Area:** comprises the land above longwall panels LW A7 to LW A19 (according to the proposed Stage 3 Modification mine plan, **Figure 1.3**), within the 20 mm subsidence contour line.

- **Original Stage 3 Mine Area**: the land above the approved mine plan longwall panels LW A6 to LW A17 within the 20 mm subsidence contour line, as assessed by the original Stage 3 Environmental Assessment (**Figure 1.2**, Umwelt 2008a).

- **Proposed Development**: the underground mining of Stage 3 longwalls based on the Stage 3 Modification mine plan (**Figure 1.3**), a modified version of the original Stage 3 mine plan (Umwelt 2008a).

1.3 Objectives of Ecological Assessment

The objectives of the Stage 3 Modification Ecological Assessment are to:

- record the flora and fauna species diversity, vegetation communities and fauna habitats occurring within the Stage 3 Modification Area;

- identify any threatened species, migratory species, endangered populations or TECs (or their habitats), listed under the TSC Act, the FM Act or the EPBC Act, that occur or have the potential to occur within the Stage 3 Modification Area;

- assess the potential impacts of the Proposed Development on threatened species, migratory species, endangered populations and TECs in accordance with the requirements of the EP&A Act and the EPBC Act;

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

- compare the impacts of the proposed Stage 3 Modification with those assessed for the approved Stage 3 mine plan, and adapt impact mitigation measures proposed in Umwelt (2008), as appropriate.

2.0 Literature Review

A review of relevant and available literature was undertaken in order to gain a greater understanding of the ecological values of the Stage 3 Modification Area and its locality. Documents reviewed included previous ecological studies relating to sites within proximity to the Stage 3 Modification Area, regional vegetation mapping, relevant papers in scientific journals and threatened species information resources such as the Office of Environment and Heritage (OEH) internet resources. A full list of references cited within this report is provided in **Section 10**.

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

2.1.1 Austar Stage 2 Subsidence Management Plan – Appendix 1 Ecological Assessment (Umwelt 2007)

Umwelt prepared an ecological assessment for the longwall mining of three longwalls (A3-A5), referred to as Stage 2 (Umwelt 2007). Field surveys were undertaken to identify threatened species, endangered populations and TECs occurring or with potential to occur in the Stage 2 area, as well as to map the vegetation communities present and to describe the fauna habitats present.

Two TSC Act listed endangered ecological communities (EECs) where recorded in the Stage 2 area, being the River Flat Eucalypt Forest and the Lower Hunter Spotted Gum – Ironbark Forest. Two threatened fauna species were recorded, the grey-crowned babbler (*Pomatostomus temporalis temporalis*) and the speckled warbler (*Pyrrholaemus saggitatus*). Two EPBC Act listed migratory species were recorded, the great egret (*Ardea alba*) and the white-bellied sea-eagle (*Haliaeetus leucogaster*). A number of other threatened flora and fauna species were found to have potential to occur in the Stage 2 Mine Area.

Analysis of changes to surface terrain, creek bed profiles and surface and groundwater regimes as a result of the predicted and upper bound subsidence for Stage 2 indicated that:

- there will be no significant changes to catchment boundaries;
- there will be no significant change to channel alignment or bank stability;
- there will be no significant change to in channel or out of channel ponding; and
- groundwater availability to riparian vegetation is not likely to substantially change as a result of mining.

To ensure the continued protection of significant ecological values of the Stage 2 Mine Area, regular monitoring of the disturbance area was recommended to identify unforeseen impacts of the underground mining, and to enable appropriate mitigation measures to be implemented to ameliorate these impacts. The monitoring program was specifically targeted towards identifying changes to the potential River-flat Eucalypt Forest EEC.

2.1.2 Austar Ecological Assessment, Stage 3 Mine Area (Longwalls A6 to A17) and Surface Infrastructure Site (Umwelt 2008b)

The Stage 3 Mine proposal documented in Umwelt (2008b) involved two components, the first being the addition of 12 longwall panels (expanding from Stage 2), and the second being the development of associated surface infrastructure. A detailed ecological survey and assessment was undertaken by Umwelt to identify the impacts of the proposed longwall

mining and surface infrastructure developments on any ecological values and to integrate into the proposals measures to avoid or minimise these impacts.

Extensive multi-season ecological surveys were conducted, a summary of the methods employed is provided in **Section 3.1** of this document.

The following threatened species, endangered populations and TECs were recorded:

- heath wrinklewort (*Rutidosis heterogama*);
- small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*);
- Lower Hunter Spotted Gum – Ironbark Forest EEC;
- River-flat Eucalypt Forest EEC;
- Hunter Lowland Red Gum Forest EEC;
- Quorrobolong Scribbly Gum Woodland EEC;
- gang-gang cockatoo (*Callocephalon fimbriatum*);
- grey-crowned babbler (*Pomatostomus temporalis temporalis*);
- speckled warbler (*Pyrrholaemus saggitata*);
- powerful owl (*Ninox strenua*);
- squirrel glider (*Petaurus norfolcensis*);
- little bentwing-bat (*Miniopterus australis*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- large-footed myotis (*Myotis adversus*); and
- eastern freetail-bat (*Mormopterus norfolcensis*).

The Surface Infrastructure Site (SIS) proposal required the clearing of an 8-10 hectare area of vegetation which included habitat for two EECs and a number of threatened species. A 17 hectare parcel of land nearby to the SIS, and with similar ecological characteristics to the SIS, was nominated as a biodiversity offset for the SIS development. In addition to the biodiversity offsets, a detailed tree-clearing procedure was developed to minimise the impacts on any hollow-bearing fauna during the construction of the SIS facilities.

Based on the subsidence predictions and modelling, it was determined that the Stage 3 longwall mining proposal would not have a significant impact on any threatened species, endangered populations or TECs.

2.1.3 Stage 2 Ecological Monitoring (Umwelt 2009, Umwelt 2010 and Umwelt 2011a)

An ecological monitoring program was established for the Stage 2 mine area. This was a commitment from the Stage 2 ecological assessment (Umwelt 2007). To date, spring and autumn monitoring surveys have been undertaken in 2008, 2009 and 2010. The outcomes

of each year of monitoring are reported in Umwelt 2009, Umwelt 2010 and Umwelt 2011a. The aim of the monitoring is to detect any impacts on the ecological values of riparian areas that may be associated with the longwall mining. The monitoring program consists of three permanent vegetation plots, and six condition assessment and photo monitoring points.

To date, there are no observable impacts on ecological values or channel geomorphology in the Stage 2 mine area, with mining of 1.5 longwall panels completed.

2.1.4 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 were 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.

2.1.5 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 7 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.

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

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 Office of Environment and Heritage (OEH). 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.

2.1.7 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*);
- speckled warbler (*Pyrrholaemus sagittatus*);
- black-chinned honeyeater (eastern subsp.) (*Melithreptus 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 norfolkensis*);
- 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.

2.1.8 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 & Driscoll 2008) on behalf of the Office of Environment and Heritage (OEH, formerly 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.

2.1.9 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 OEH Atlas of NSW Wildlife (January 2011) for threatened flora and fauna species recorded within a 10 kilometre radius of the Stage 3 Modification Area; and

- a search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Database (January 2011) for threatened flora and fauna species with potential to occur (based on DSEWPC habitat modelling) within a 10 kilometre radius of the Stage 3 Modification Area.

The results of these database searches were used to identify threatened species, migratory species, endangered populations or TECs which may occur within the Stage 3 Modification Area, and to gain an understanding of the extent of the distribution of known records of species within the locality.

3.0 Survey Methods

The methods for the original Stage 3 assessment (Umwelt 2008b) included a comprehensive field survey program which was spread across multiple seasons. Given that the original and modified Stage 3 mine plans fall within a very similar footprint, the surveys and results from Umwelt (2008b) have been used as the basis of this assessment, with supplementary surveys being undertaken to cover additional areas in the Stage 3 Modification Area. The supplementary surveys were undertaken over two days in September 2010.

The methods employed for the original Stage 3 Mine Area assessment (Umwelt 2008b) are summarised in **Section 3.1**, while the methods for the supplementary surveys for the proposed Stage 3 Modification Project are detailed in **Sections 3.2** and **3.3**.

3.1 Summary of Original Stage 3 Mine Area Assessment Methods (Umwelt 2008b)

A summary of the flora survey effort employed for the original Stage 3 Mine Area assessment (Umwelt 2008b) is provided below (refer to Umwelt (2008b) for full details):

- 11 days of surveys across three seasons;
- 13 systematic vegetation plots;
- 9 vegetation transects; and
- 7 roadside assessment points.

The locations of these flora survey points are shown on **Figure 3.1**.

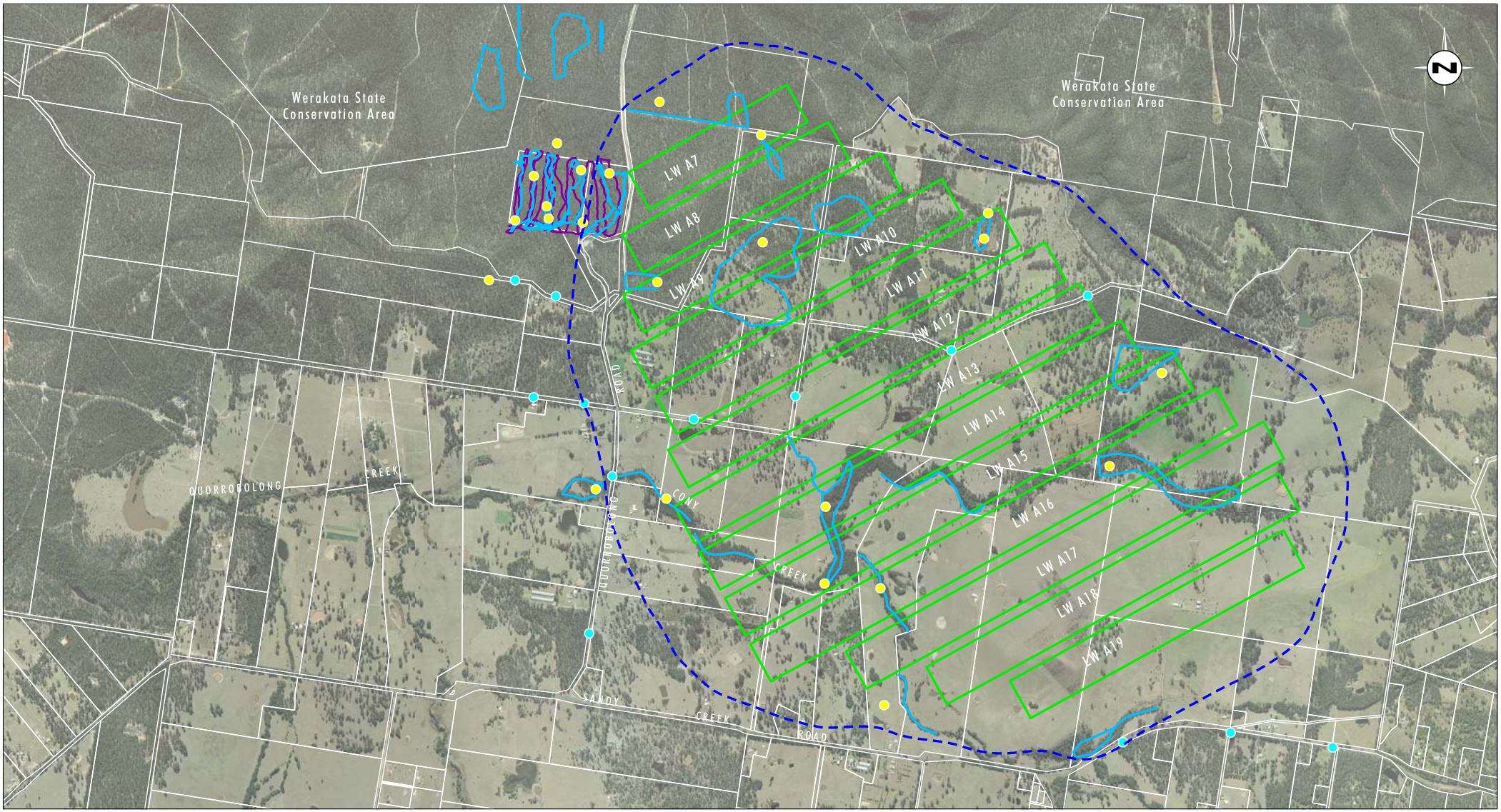
A summary of the fauna survey effort employed for the original Stage 3 Mine Area assessment (Umwelt 2008b) is provided in **Tables 3.1** and **3.2**. The locations of the fauna survey points are shown on **Figure 3.2**.

Table 3.1 - Total Trapping Effort (Umwelt 2008b)

Season (2006-2008)	Total Trap Nights						
	Elliot A (ground)	Elliot B (ground)	Elliot B (arboreal)	Hair Funnel (ground)	Hair Funnel (arboreal)	Harp Trap	Cage Trap
Winter	0	0	90	1050	420	0	0
Spring	80	80	40	560	140	4	16

Table 3.2 – Total Area Search Effort (Umwelt 2008b)

Season (2006-2008)	Total Person Hours				
	Spotlight (Walk)	Spotlight (Drive)	Amphibian & reptile (day)	Amphibian & reptile (night)	Diurnal Bird
Winter	6	4	6	4	6
Spring	10	4	6	2	6



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

0 0.5 1 1.35km
1:30 000

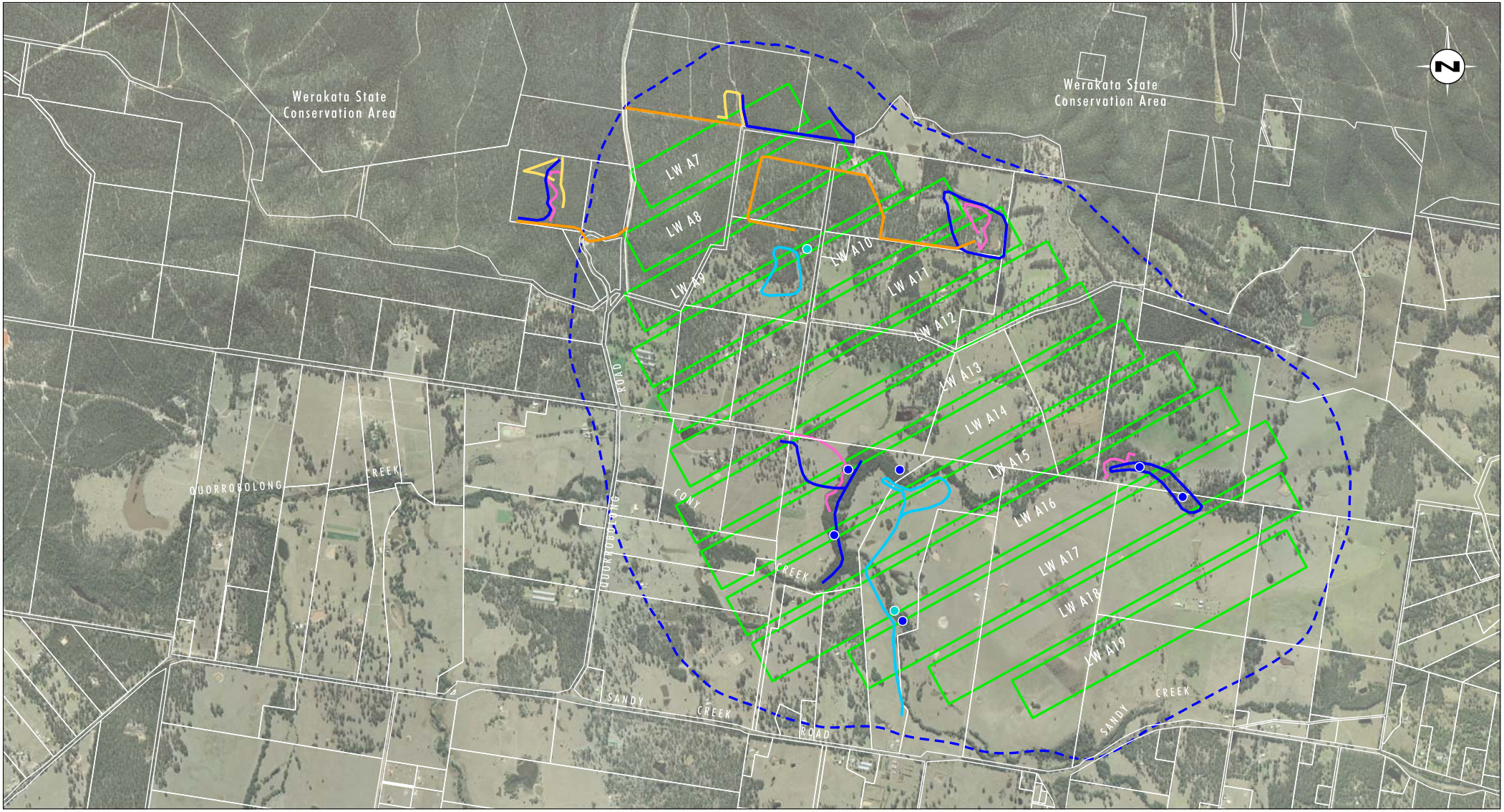
Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Targeted Threatened Flora Searches
- Vegetation Transect
- Quadrat Locations
- Roadside Vegetation Assessment Point

FIGURE 3.1

Flora Survey Locations

File Name (A4): R65_V1/2274_809.dgn



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

0 0.5 1 1.35km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Winter Fauna Trapline
- Spring Fauna Trapline
- Driving Spotlight Route
- Walking Spotlight Route
- Additional Spotlighting Transect Location
- Additional Amphibian Search Location
- Aquatic Sampling Locations

FIGURE 3.2

Fauna Survey Locations

File Name (A4): R65_V1/2274_808.dgn

In addition to the terrestrial surveys, an aquatic field survey was undertaken which involved sampling at six sites within the Stage 3 Mine Area, five of which were situated along Cony Creek and one along Sandy Creek. The field survey comprised both macro-invertebrate sampling at each of these six sites and an in-stream and riparian habitat assessment.

3.2 Stage 3 Modification Area Flora Survey

3.2.1 Aims

Flora surveys within the Stage 3 Modification Area were undertaken to supplement the flora surveys prepared for the original Stage 3 Mine Area assessment (Umwelt 2008b). The aims of the supplementary flora field surveys were to:

- survey additional areas of the Stage 3 Modification Area to supplement records of the flora species diversity already documented in Umwelt (2008b);
- collect data to map the vegetation communities of the Stage 3 Modification Area, expanding on that prepared for Umwelt (2008b);
- describe the general health and condition of the vegetation of the Stage 3 Modification Area;
- determine if any threatened flora species, endangered populations or TECs are present or have potential to occur within the Stage 3 Modification Area; and
- gather sufficient information to enable an accurate assessment of the impacts of the Proposed Development on the ecological values of the Stage 3 Modification Area.

3.2.2 Plot-based and Transect Surveys

The Stage 3 Modification Area surveys focused on those areas included in the revised mine plan that were not accessed for the original Stage 3 Mine Area assessment (Umwelt 2008b). Two vegetation plots and five transects were surveyed, the locations of which are shown on **Figure 3.1**. The survey particularly focused on riparian areas, as this is where any potential subsidence impacts from longwall mining are most likely to be concentrated.

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 OEH 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 3.3**).

Table 3.3 - 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.

Five meandering transects of no fixed length or width were surveyed on foot along which flora species observed were recorded, along with notes on the condition of the vegetation and information to assist with vegetation community delineation. The objectives of the five transects were to:

- search for threatened flora species and their habitats;
- assist in the delineation of vegetation communities;
- enable greater coverage of the Stage 3 Modification Area than would be achieved by plot-based sampling alone; and
- contribute to floristic knowledge of the Stage 3 Modification Area.

3.2.3 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 2011), 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 is unknown or uncertain, it is lodged with the National Herbarium of New South Wales at the Royal Botanic Gardens Sydney.

3.2.4 Vegetation Mapping

The vegetation communities of the Stage 3 Modification Area were mapped through a combination of aerial photograph interpretation, comparison with regional vegetation

mapping and ground-truthing through field surveys. The vegetation mapping prepared for Umwelt (2008) was modified and extended to incorporate all areas within the Stage 3 Modification footprint, using the data obtained from the supplementary surveys, as well as that from original surveys.

3.3 Stage 3 Modification Area Fauna Survey

3.3.1 Aims

The aims of the fauna field surveys were to:

- record the fauna species diversity present within the additional areas of the Stage 3 Modification Area, and to identify and characterise the different habitat types present;
- determine if any threatened fauna species or endangered populations are present or have potential to occur based on the habitats present; and
- gain information on the current health and ecological condition of the habitats present.

3.3.2 Fauna Methods

Given that extensive fauna surveys were undertaken for the original Stage 3 Mine Area assessment (Umwelt 2008b), the survey for the Stage 3 Modification Area comprised opportunistic observations only. All fauna species observed during the two days of field survey in spring 2010 were recorded, along with any secondary traces of fauna such as tracks, scats and nests. The habitats present were assessed to assist in the consideration of whether any threatened fauna species could potentially occur, and the ecological condition of the habitats was also considered. Fauna survey locations from Umwelt (2008) are shown on **Figure 3.2**.

3.3.3 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 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% 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

Scientific Name	Common Name
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 the Stage 3 Modification 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.

4.0 Flora Results

The following sections describe the floristic diversity and vegetation communities of the Stage 3 Modification Area, in addition to significant ecological values such as threatened flora species, TECs and any records of regional significance. **Section 4.1** also provides a brief description of the environmental setting of the Stage 3 Modification Area, including soil characteristics and geomorphology.

These results draw on the outcomes of field surveys for the original Stage 3 Mine Area assessment (Umwelt 2008b) as well as those for the current Stage 3 Modification Area assessment.

4.1 Environmental Setting, Soils and Geomorphology

The Stage 3 Modification Area lies within the Sydney Basin Bioregion, and the North Coast Botanical Subdivision. A large proportion of the Stage 3 Modification 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 Stage 3 Modification Area encompass a small part of the Broken Back Range.

The main tributary of the Stage 3 Modification Area is Cony Creek, which traverses the central portion. Sandy Creek flows in a westerly direction along the southern boundary of the Stage 3 Modification Area, before turning north to its confluence with Cony Creek. The Stage 3 Modification 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 Modification Area, in particular in the northern parts, despite there being a reasonable cover of riparian vegetation.

There are two main soil landscapes within the Stage 3 Modification Area, being the Quarrabolong soil landscape and the Aberdare soil landscape (Kovac & 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.

4.2 Flora Species

A full list of flora species recorded in the Stage 3 Modification Area is provided in **Appendix A**. A total of 299 flora species have been recorded within the Stage 3 Modification Area (including those from Umwelt 2008b), of which 257 species are native and 42 are introduced. Two species were from the Class Cycadopsida (Cycads), eight species were from the Class Filicopsida (ferns), and 289 from Magnoliopsida (flowering plants) (of which 71 were from sub-class Liliidae (monocots) and 218 from sub-class Magnoliidae (dicots)). Flora species were recorded from 83 plant families, the most speciose being Fabaceae (41 species), Myrtaceae (36 species), Poaceae (28 species) and Asteraceae (25 species).

Two threatened flora species were recorded, being heath wrinklewort (*Rutidosis heterogama*) and white-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Each is discussed in further detail in **Section 4.4**.

4.3 Vegetation Communities of the Stage 3 Modification Area

The proposed Stage 3 Modification Area supports seven vegetation communities (**Figure 4.1**). The slopes and ridges of the Stage 3 Modification Area support Lower Hunter Spotted Gum – Ironbark Forest, while the dominant communities in riparian and floodplain environments are the Riparian Red Gum Forest and Swamp Oak Riparian Forest. Large parts of the Stage 3 Modification Area comprise modified communities such as Derived Grassland/Pasture and Regeneration. The amount of each community present in the Stage 3 Modification Area is presented in **Table 4.1**. Descriptions of the characteristics of each of these communities are provided in **Sections 4.3.1** to **4.3.8**. Note that the map unit 'Cultivated' is not described here, as it comprises planted crops only.

Table 4.1 – Vegetation Communities of the Stage 3 Modification Area

Vegetation Community	Area (ha)
Riparian Red Gum Forest	48.7
Swamp Oak Riparian Forest	54.8
Lower Hunter Spotted Gum – Ironbark Forest	342.2
Derived Grassland/Pasture	482.2
Derived Grassland with Scattered Canopy Trees	237.2
Woollybutt Open Forest	5.6
Regeneration	9.2
Cultivated	17.5
TOTAL	1197.4

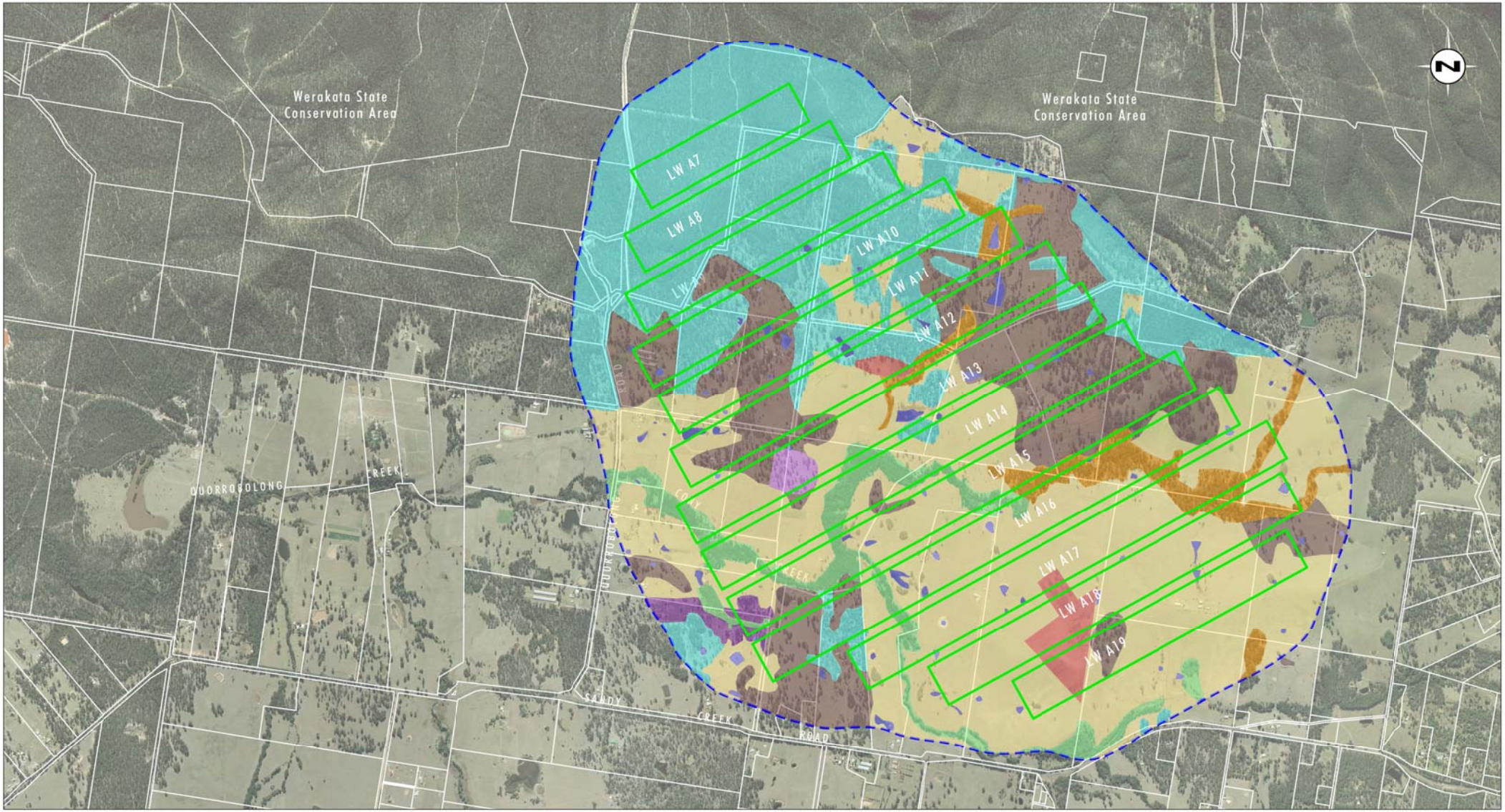
4.3.1 Riparian Red Gum Forest

There are several occurrences of Riparian Red Gum Forest within the Stage 3 Modification Area (**Figure 4.1**, **Plate 1**), each of which is associated with drainage flats or lower slopes associated with drainage flats. There are 48.7 hectares of this community within the Stage 3 Modification Area.

The most characteristic dominant canopy species occurring in the Riparian Red Gum Forest community of the Stage 3 Modification Area are cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) and forest red gum (*Eucalyptus tereticornis*), and likely hybrid forms between the two red gum 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 hybrids. 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 4.1**). 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 Stage 3 Modification Area are typically very narrow, the influence of adjoining communities (typically Derived Grassland/Pasture or Spotted Gum – Ironbark Forest) is strong.

The Riparian Red Gum Forest 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*). The sub-canopy has a height of up to 10 metres, and a relatively sparse foliage cover of 10% to 20%. In some 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



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

0 0.5 1 1.35km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Cultivated
- Dam
- Derived Grassland / Pasture
- Derived Grassland with Scattered Canopy Trees
- Regeneration
- Riparian Red Gum Forest
- Lower Hunter Spotted Gum Ironbark Forest
- Swamp Oak Riparian Forest
- Woollybutt Open Forest Remnant

FIGURE 4.1

Vegetation Communities

File Name (A4): R65_V1/2274_810.dgn

PLATE 1
Riparian Red Gum Forest

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 generally has a foliage cover of less than 20%, however there are some localised patches where this is denser. The height of this stratum ranges between 1 and 5 metres.

The ground stratum of the Riparian Red Gum Forest within the Stage 3 Modification Area comprises a diversity of native grasses and other herbs. The composition of the ground stratum is variable across the different remnants of the Stage 3 Modification Area. The most frequently 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*), kikuyu (*Pennisetum clandestinum*) and plantain (*Plantago lanceolata*).

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 Stage 3 Modification 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 4.5.1**.

4.3.2 Swamp Oak Riparian Forest

Swamp Oak Riparian Forest is found in the heavily disturbed areas of Cony Creek and Sandy Creek (**Figure 4.1**, **Plate 2**). In the Stage 3 Modification Area, 54.8 hectares of this community occurs. The community typically occurs as a very narrow band of riparian vegetation which is adjoined by Derived Grassland/Pasture 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 is possibly an indicator that 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.

PLATE 2
Swamp Oak Riparian Forest

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, despite the removal of grazing in some locations.

The Swamp Oak Riparian Forest of the Stage 3 Modification 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. After extensive assessment and consideration, it was determined that the Swamp Oak Riparian Forest in the Stage 3 Modification Area is not consistent with the River-Flat Eucalypt Forest EEC. Further discussion of this justification is provided in **Section 4.5.1**.

4.3.3 Lower Hunter Spotted Gum – Ironbark Forest

Lower Hunter Spotted Gum – Ironbark Forest occupies approximately 342.2 hectares of the Stage 3 Modification Area (**Figure 4.1**, **Plate 3**), where it occurs on the dry slopes and crests where the soil is relatively infertile. 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 Stage 3 Modification Area. Localised variants occur in response to environmental variables such as aspect, topography, geology and disturbance history (including fire and forestry practices).

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

PLATE 3
Lower Hunter Spotted Gum - Ironbark Forest

dominant on the lower slopes. The canopy stratum generally has a cover ranging between 20 and 30%, and has a height range of 12 to 18 metres.

Lower Hunter 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*.

Lower Hunter 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 Stage 3 Modification Area, ranging from 5% to 90%. This is likely to be a reflection of the different disturbance histories relating to this community across the Stage 3 Modification 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.

The Lower Hunter Spotted Gum – Ironbark Forest community recorded within the Stage 3 Modification 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 Stage 3 Modification 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.

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 Lower Hunter Spotted Gum – Ironbark Forest within the Stage 3 Modification Area was found to be consistent with the TSC Act listed EEC Lower Hunter Spotted Gum – Ironbark

Forest. Further discussion of this EEC is provided in **Section 4.5.2**. The community is also equivalent to the Lower Hunter Spotted Gum – Ironbark Forest, Map Unit 17 (NPWS 2000).

4.3.4 Derived Grassland/Pasture

A large proportion (482.2 hectares) of the Stage 3 Modification Area comprises Derived Grassland/Pasture (**Figure 4.1**, **Plate 4**). The areas in which Derived Grassland/Pasture 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 Stage 3 Modification Area, the Derived Grassland/Pasture 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/Pasture 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/Pasture varies strongly between the various private landholdings throughout the Stage 3 Modification Area, which is the result of land management practices differing between landholdings.

4.3.5 Derived Grassland with Scattered Canopy Trees

A variant of Derived Grassland/Pasture occurs within the Stage 3 Modification Area, being Derived Grassland with Scattered Canopy Trees (**Figure 4.1**). This community covers 237.2 hectares and 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*) and grey box (*Eucalyptus moluccana*). 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*).

Due to the highly disturbed nature of this map unit, it frequently does not support the structural or floristic components of the vegetation community it would have once represented prior to clearing and grazing practices.

4.3.6 Woollybutt Open Forest

A small remnant (5.6 hectares) of what may have previously comprised an open forest dominated or sub-dominated by woollybutt (*Eucalyptus longifolia*) occurs in the Stage 3 Modification Area (**Figure 4.1**, **Plate 5**). The regional significance of this community is described further in **Section 4.8**.

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.

PLATE 4
Derived Grassland / Pasture

PLATE 5
Woollybutt Open Forest 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.

4.3.7 Regeneration

There are a small number of patches of regenerating native vegetation mapped within the Stage 3 Modification Area (**Figure 4.1**), covering 9.2 hectares. The dominant species regenerating varies with topographic location, however is typically a monoculture of colonising species such as *Melaleuca linearifolia, Eucalyptus* spp. and ball honeymyrtle (*Melaleuca nodosa*). There is very little species or structural diversity in these stands.

4.3.8 Cultivated

This map unit refers to those areas that are used for agricultural cropping purposes. These areas are generally devoid of native flora species and typically are mono-specific stands of a particular crop variety.

4.4 Threatened Flora Species, Endangered Flora Populations and TECs

The following sections outline the threatened flora species, endangered flora populations and TECs recorded within the Stage 3 Modification Area and those with potential to occur.

4.4.1 Recorded Threatened Flora Species

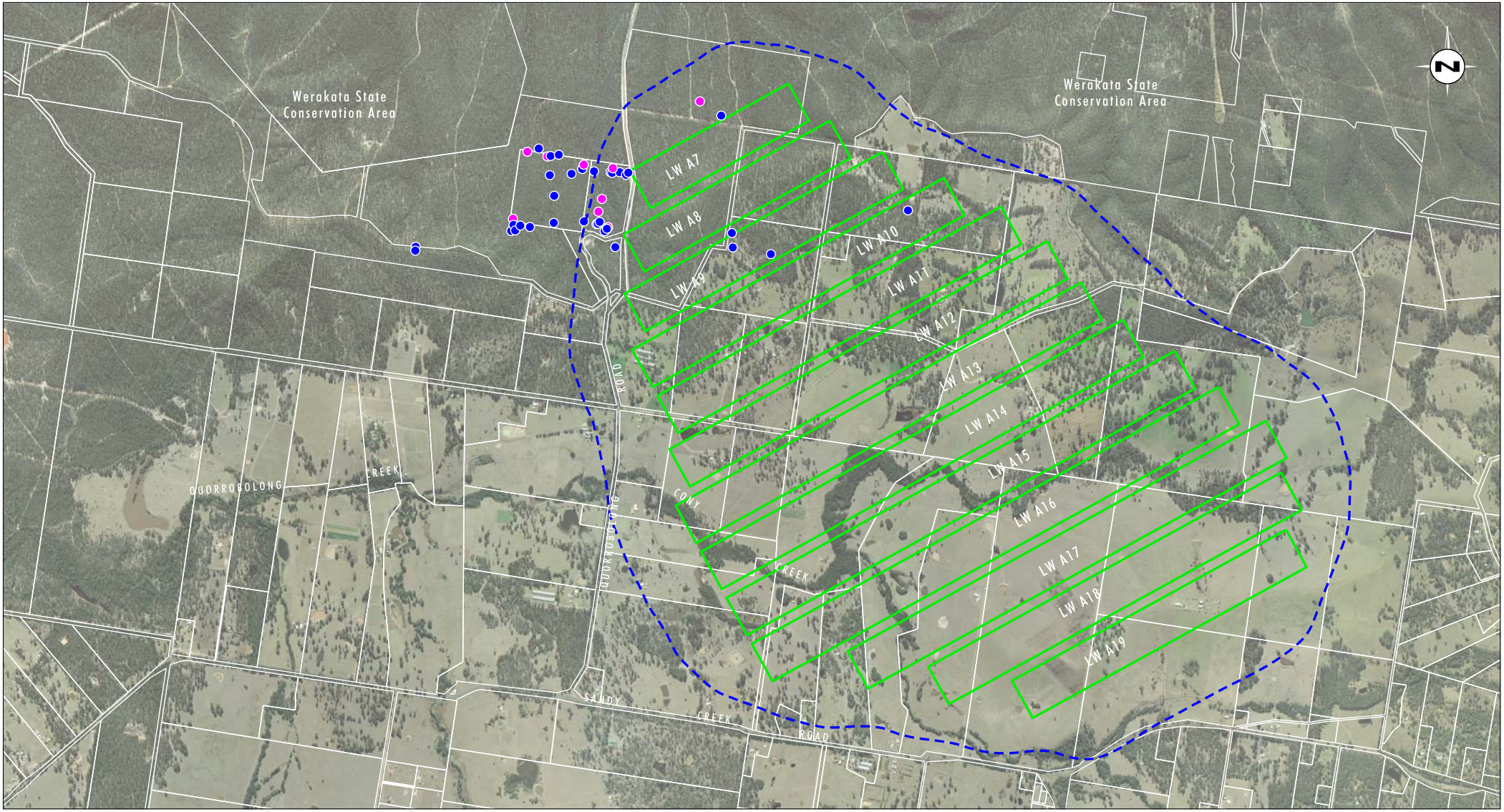
Two threatened flora species were recorded within the Stage 3 Modification Area during the field surveys, being heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Both species were recorded in the northern portions of the Stage 3 Modification Area, and both are listed as vulnerable under the TSC Act and the EBPC Act. The recorded locations of these species are shown on **Figure 4.2**, however the actual extent of occurrence of each species is expected to be greater. 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 DECCW Atlas of NSW Wildlife for the Cessnock 1:100,000 topographic map sheet is provided on **Figure 4.3** (note this was prepared based on a 2008 atlas search and therefore provides an indication only of the local distribution of these species). **Figure 4.3** indicates that potential habitat for the two species is relatively widespread within the locality, particularly to the north and north-east of the Stage 3 Modification Area.

Assessments of significance for *Rutidosis heterogama* and *Grevillea parviflora* subsp. *parviflora* are provided in **Appendices C** (EP&A assessment) and **D** (EPBC assessment).

4.4.2 Threatened Flora Species with Potential to Occur

Lists of all threatened flora species compiled from the two ecological database searches and other sources from the literature review are provided in **Appendix B**.

Table 4.2 lists those threatened flora species that were not recorded within the Stage 3 Modification Area, however were assessed to have potential to occur based on the presence of suitable habitats. This table also indicates whether each species were found to have any reasonable potential to be impacted by the Proposed Development, and therefore would require a further assessment of significance.



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

0 0.5 1 1.35km
1:30 000

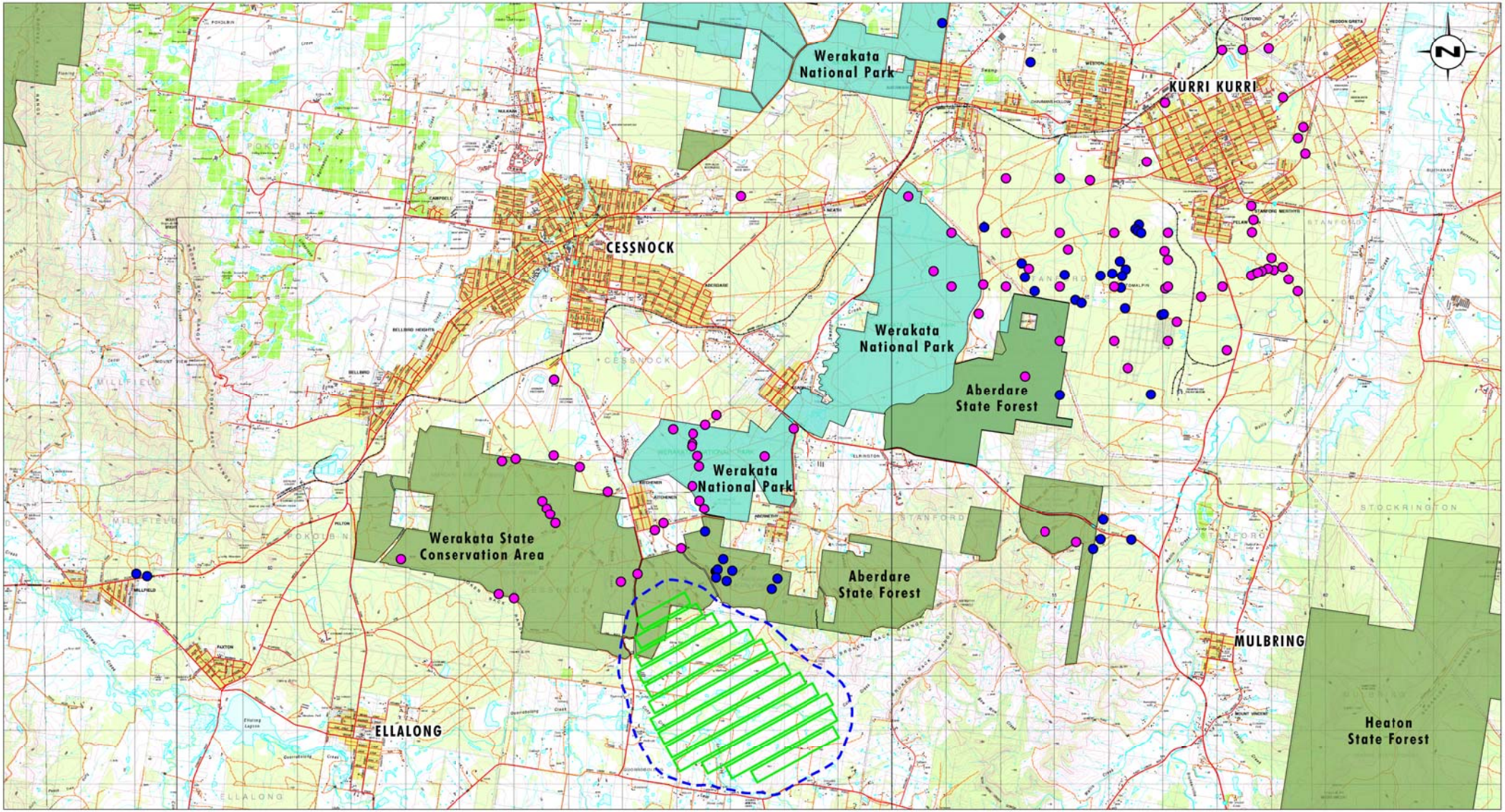
Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- *Rutidosis heterogama*
- *Grevillea parviflora* subsp. *parviflora*

FIGURE 4.2

Threatened Flora Locations

File Name (A4): R65_V1/2274_814.dgn



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

0 1 2.5 5km
1:100 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- *Rutidosis heterogama*
- *Grevillea parviflora* subsp. *parviflora*

FIGURE 4.3

Threatened Flora Locations
(DECCW Atlas of NSW Wildlife
Cessnock 1:100 000 Map)

File Name (A4): R65_V1/2274_811.dgn

Table 4.2 - Threatened Flora Species with Potential to Occur within the Stage 3 Modification Area

Species	Status	Potential to Occur	Potential to be Impacted?
Callistemon linearifolius	V (TSC)	Yes	No
Bynoes wattle *Acacia bynoeana*	V (EPBC) E (TSC)	Yes	No
leafless tongue orchid *Cryptostylis hunteriana*	V (EPBC) V (TSC)	Yes	No
Illawarra greenhood *Pterostylis gibbosa*	V(TSC)	Yes	No
Groves paperbark *Melaleuca groveana*	V (TSC)	Yes	No

Key:
TSC = *Threatened Species Conservation Act* 1995
EPBC = *Environment Protection and Biodiversity Conservation Act* 1999
E = Endangered
V = Vulnerable

4.5 Threatened Ecological Communities

An initial assessment identified the following eight TECs as having potential to occur within the Stage 3 Modification Area:

- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin, and South-east Corner Bioregions (EEC, TSC);
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South-east Corner Bioregions (EEC, TSC);
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-east Corner Bioregions (EEC, TSC);
- Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion (EEC, TSC);
- Hunter Lowland Red Gum Forest in the Sydney Basin and NSW North Coast Bioregions (EEC, TSC);
- Freshwater Wetlands on Coastal Floodplains of the North Coast, Sydney Basin and South-east Corner Bioregions (EEC, TSC);
- Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion (EEC, TSC);
- White Box – Yellow Box – Blakelys Red Gum Woodland (EEC, TSC); and
- White Box – Yellow Box – Blakelys Red Gum Grassy Woodland and Derived Native Grasslands (CEEC, EPBC).

A summary of the assessment of the potential to occur for each of these TECs is presented in **Appendix B.**

The two EECs that were found to be present within the Stage 3 Modification Area are the Lower Hunter Spotted Gum – Ironbark Forest EEC and the River-flat Eucalypt Forest EEC

(refer to **Figure 4.4**). A summary of the extent of the two EECs is provided in **Table 4.3**, while further descriptions of these EECs are provided in **Sections 4.5.1** to **4.5.2**.

Table 4.3 – EECs Recorded within the Stage 3 Modification Area and their Extent

Endangered Ecological Communities	Area (ha)
River-flat Eucalypt Forest	48.7
Lower Hunter Spotted Gum – Ironbark Forest	342.2
TOTAL	**390.9**

It should be noted that a small stand of the Quorrobolong Scribbly Gum Woodland EEC occurs just outside of the Stage 3 Modification Area, to the south-east of the upper bound subsidence boundary. No parts of this EEC will be disturbed as a result of the proposed underground mining development.

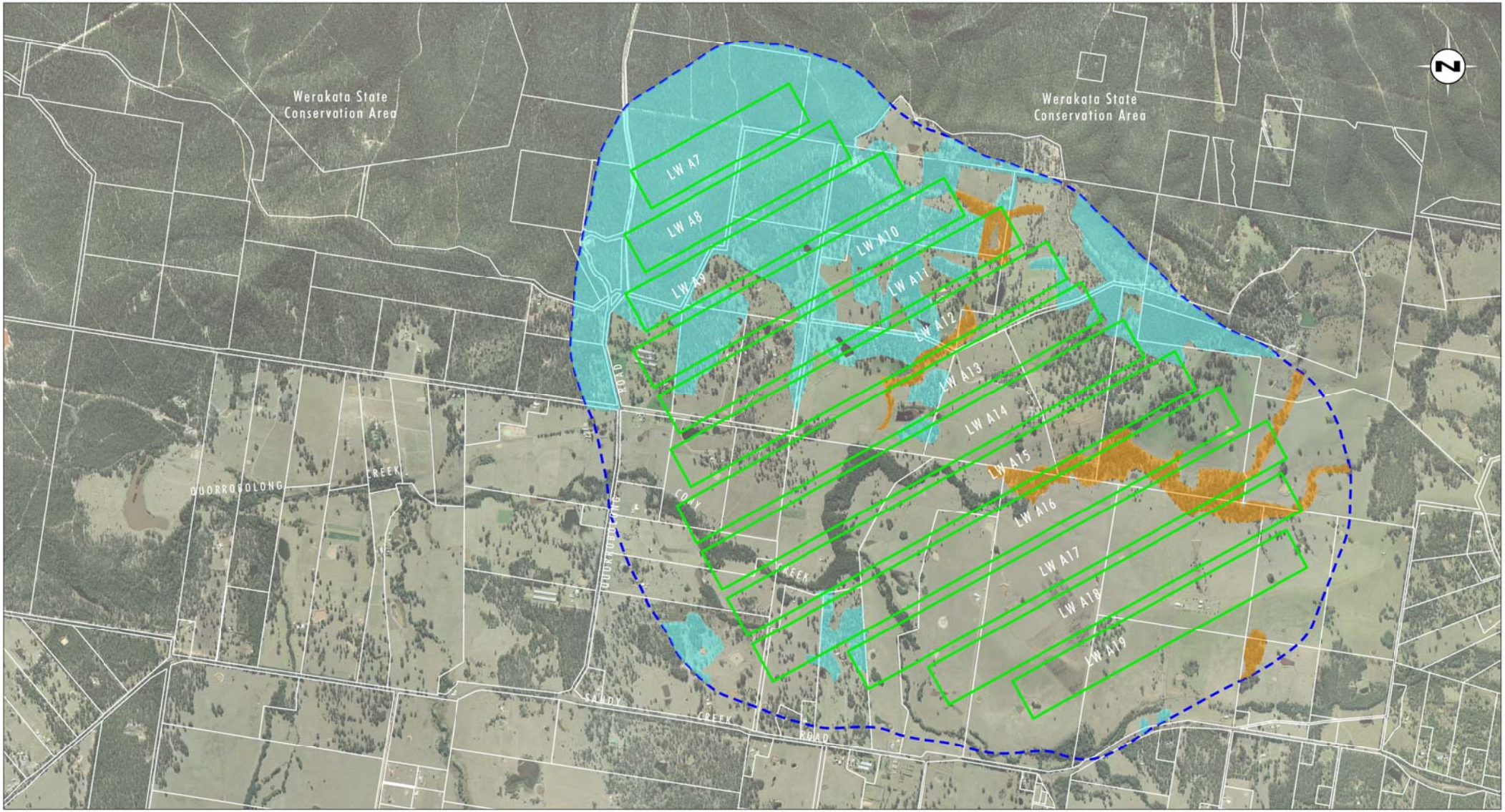
4.5.1 River-flat Eucalypt Forest EEC

Based on an assessment of the structural and floristic composition of the riparian communities within the Study Area, it was concluded that 48.7 hectares of the River-flat Eucalypt Forest EEC occurs within the Stage 3 Modification Area, along Cony Creek and its tributaries (**Figure 4.4**). This includes only those areas mapped as Riparian Red Gum Forest (**Section 4.3.1**). Swamp Oak Riparian Forest was found to be inconsistent with this EEC, for reasons discussed further in this section.

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 2005a). 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 ASL (NSW Scientific Committee 2005a). The Riparian Red Gum Forest of the Stage 3 Modification Area occurs on 'alluvial flats' and 'drainage lines' and is associated with a



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

0 0.5 1 1.35km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- River-flat Eucalypt Forest
- Lower Hunter Spotted Gum Ironbark Forest

FIGURE 4.4

Endangered Ecological Communities

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 4.5** shows those areas of these catchments which comprise a floodplain under the flood-frequency component of the definition by the NSW Scientific Committee (2005a). 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 Stage 3 Modification 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 of 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 4.1**) was identified to be 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 2005a), some of the important features that characterise the River-flat Eucalypt Forest EEC 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 Stage 3 Modification Area, mapped by Umwelt as Swamp Oak Riparian Forest, does not comprise the River-flat Eucalypt Forest EEC.

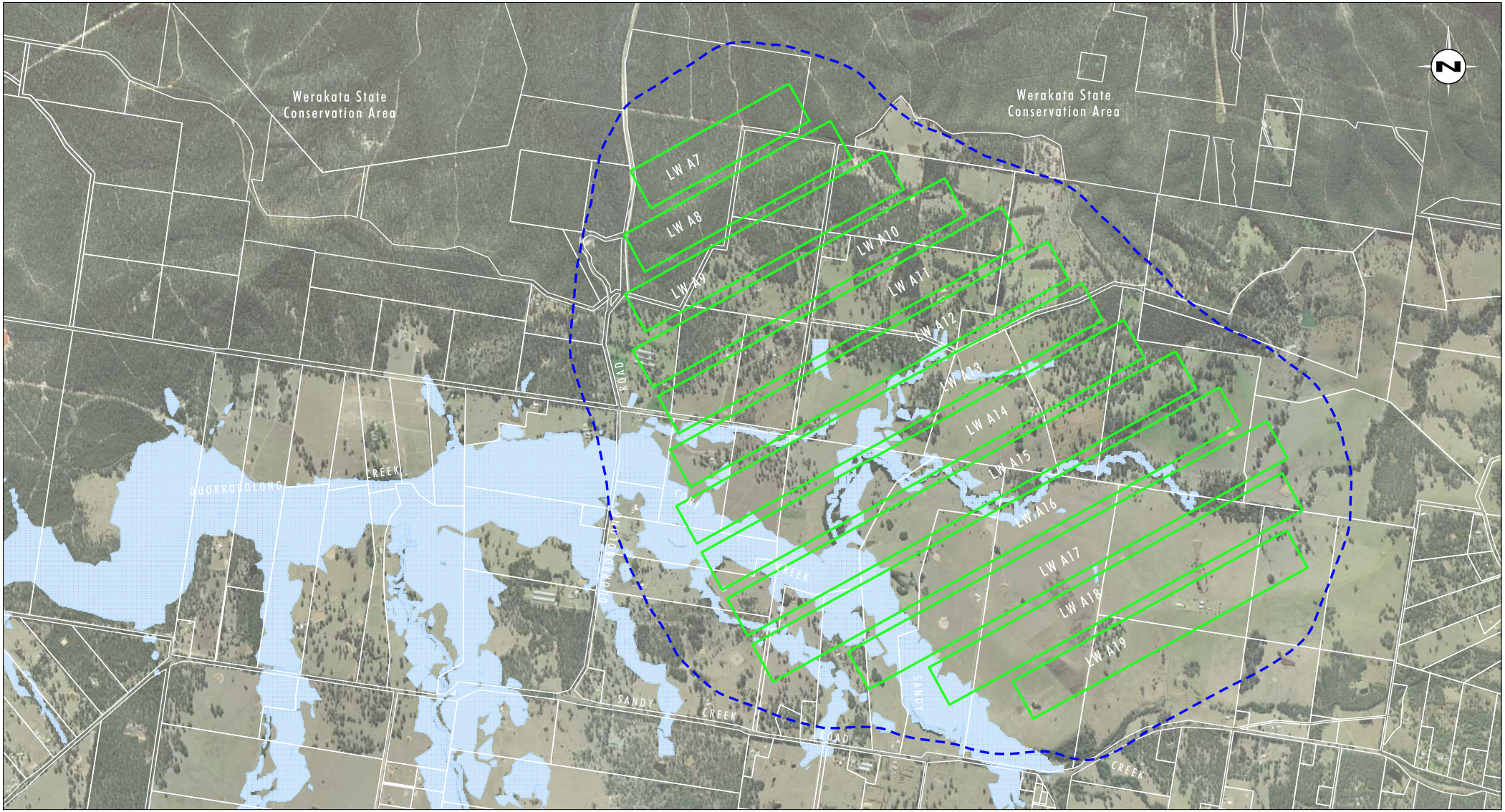
A 7 part test of significance (in accordance with the EP&A Act) was undertaken to determine if the Proposed Development would have a significant impact on this EEC (**Appendix C**).

4.5.2 Lower Hunter Spotted Gum – Ironbark Forest EEC

The Spotted Gum – Ironbark Forest recorded within the Stage 3 Modification Area was found to be consistent with the Lower Hunter Spotted Gum – Ironbark Forest EEC, as described by the NSW Scientific Committee (2005b). A description of the general characteristics of the EEC and the characteristics of the EEC within the Stage 3 Modification 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*



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

0 0.5 1 1.5km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- 1 in 100 Year Flood Level

FIGURE 4.5

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

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 Stage 3 Modification Area (described in **Section 4.3.3**) concludes that the EEC is present in the Stage 3 Modification Area. Approximately 342.2 hectares of the Lower Hunter Spotted Gum – Ironbark Forest EEC occur in the Stage 3 Modification Area (**Figure 4.4**).

The potential for the Proposed Development to have a significant impact on this EEC is assessed in **Appendix C**.

4.6 Endangered Flora Populations

No endangered flora populations were identified within the Stage 3 Modification Area. Four endangered flora populations are relevant to the Hunter catchment (in which the Stage 3 Modification Area occurs):

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

The potential for each of these endangered flora populations to occur within the Stage 3 Modification Area is assessed in Table 1 of **Appendix B.** The assessment concludes that no endangered flora populations have potential to occur within the Stage 3 Modification Area.

4.7 Regionally Significant Flora Species

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

The Stage 3 Modification 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 Stage 3 Modification Area (**Table 4.4**).

Table 4.4 - Regionally Significant Species Recorded within the Stage 3 Modification Area

Species	Criteria
Acacia longissima	D U W
Acacia parvipinnula	N W
Astroloma humifusum	N
Bossiaea obcordata	?U
Caladenia catenata	W
Corymbia maculate	W
Diuris aurea	N
Eleocharis gracilis	W
Eucalyptus amplifolia subsp. *amplifolia*	T
Eucalyptus canaliculata	D
Eucalyptus eugenoides	?W
Eucalyptus fergusonii subsp. *fergusonii*	
Eucalyptus globboidea	W
Eucalyptus longifolia	N D
Eucalyptus punctata	N A
Eustrephus latifolius	W
Glossodia major	-
Glossodia minor	U
Gompholobium minus	N
Goodenia rotundifolia	S
Grevillea parviflora subsp. *parviflora*	R V (TSC) V (EPBC)
Hovea linearis	N
Imperata cylindrica var. *major*	?W
Jasminum volubile	S
Leptospermum trinervium	W
Lissanthe strigosa	?U
Lyperanthus suaveolans	-
Macrozamia flexuosa	L S
Maytenus silvestris	U
Melaleuca styphelioides	W
Oxylobium pulteneae	L
Parsonsia straminea	?W
Podolobium ilicifolium	?W
Pterostylis nutans	-
pRutidosis heterogama	U

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 35 regionally significant flora species emphasise the ecological values of the Stage 3 Modification Area, however they are not legislatively protected.

4.8 Regionally Significant Ecological Communities

Two ecological communities which are regarded to be regionally significant are known to occur within or in proximity to the Stage 3 Modification 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 Stage 3 Modification 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 (2008) 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 Stage 3 Modification 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 (2008). 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 Modification Area (**Figure 4.1**). This remnant is described in **Section 4.3.6**.

5.0 Fauna Results

Following is a summary of the results of the original Stage 3 Mine Area surveys (Umwelt 2008b) and the supplementary surveys undertaken in September 2010 for the Stage 3 Modification Area.

5.1 Fauna Species Recorded

Sections 5.1.1 to **5.1.4** provide a summary of the fauna species recorded within the Stage 3 Modification Area during field surveys. A full list of the fauna species recorded in the Stage 3 Modification Area is provided in **Appendix E**. Within the Stage 3 Modification Area a total of 123 fauna species were recorded, including 83 birds, 9 amphibians, 6 reptiles and 25 mammals.

5.1.1 Birds

A total of 83 bird species have been recorded within the Stage 3 Modification Area. 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*). A number of birds more commonly associated with wetland habitats were recorded, including white-faced heron (*Egretta novaehollandiae*), Australian white ibis (*Threskiornis molucca*), Eurasian coot (*Fulica atra*), Australian wood duck (*Chenonetta dubata*) and the Pacific black duck (*Anas superciliosa*).

Six threatened bird species were recorded within the Stage 3 Modification Area, being the grey-crowned babbler (*Pomatostomus temporalis temporalis*), the speckled warbler (*Chthonicola sagittatus*), gang gang cockatoo (*Callocephalon fimbriatum*), powerful owl (*Ninox strenua*), little lorikeet (*Glossopsitta pusilla*) and scarlet robin (*Petroica boodang*). The locations of threatened fauna species recorded in the Stage 3 Modification Area are shown on **Figure 5.1**.

A number of migratory bird species were recorded, including those listed as migratory under the EPBC Act being the rainbow bee-eater (*Merops ornatus*), satin flycatcher (*Myiagra cyanoleuca*) and the white-bellied sea-eagle (*Haliaeetus leucogaster*).

5.1.2 Amphibians

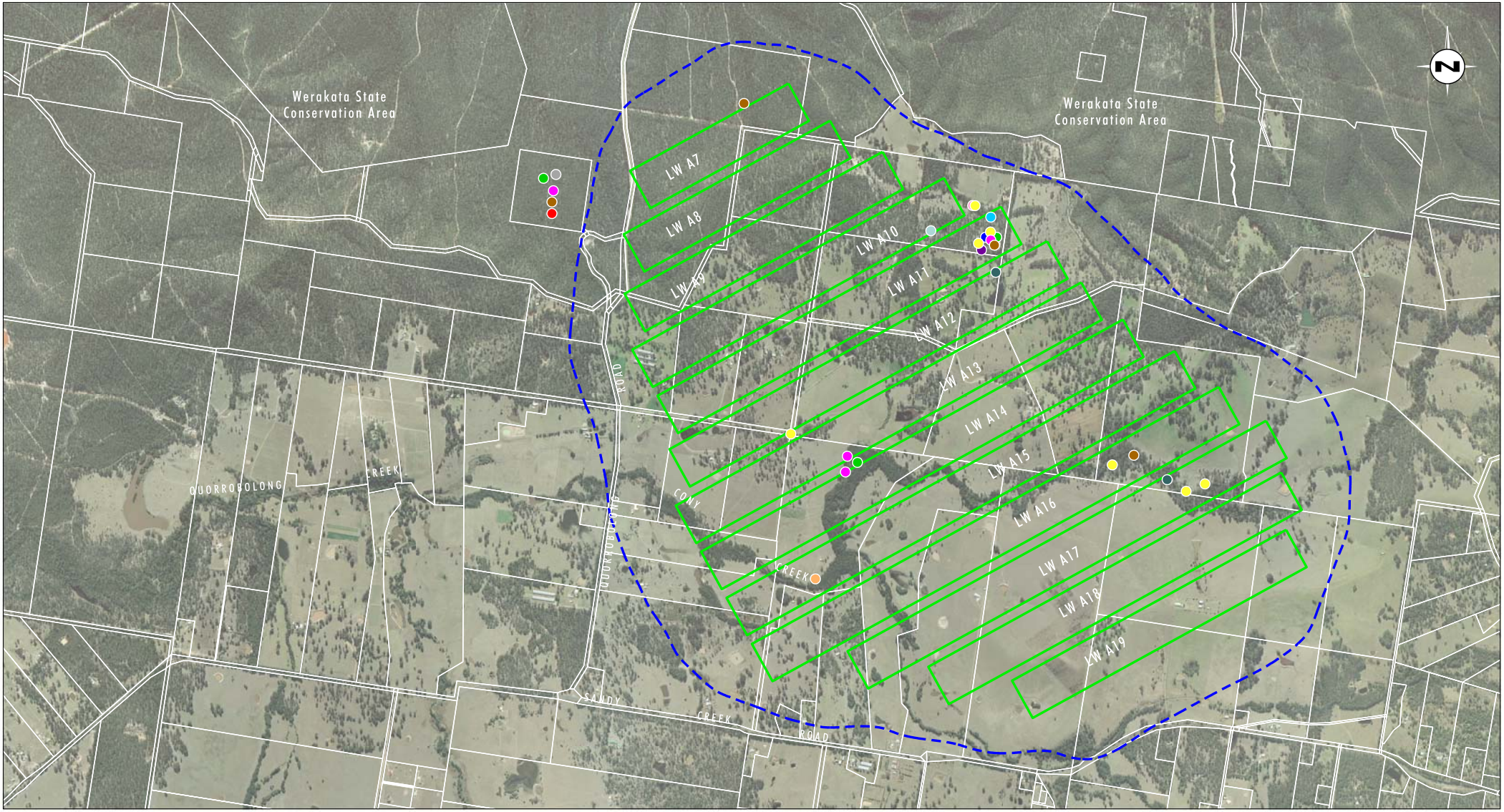
Nine frog species have been recorded within the Stage 3 Modification Area, which primarily included locally common species such as the common eastern froglet (*Crinia signifera*), striped marsh-frog (*Limnodynastes peronii*) and the spotted marsh-frog (*Limnodynastes tasmaniensis*).

No threatened amphibian species were recorded within the Stage 3 Modification Area.

5.1.3 Reptiles

Six reptile species have been recorded within the proposed Stage 3 Modification Area during the surveys.

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



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

0 0.5 1 1.35km
1:30 000

Legend

- Proposed Stage 3 Modification Longwall Layout
- 20mm Subsidence Contour for Proposed Stage 3 Modification
- Little bentwing-bat
- Eastern freetail-bat
- Large-footed myotis
- Eastern bentwing-bat
- Gang-gang cockatoo
- Squirrel glider
- Eastern false pipistrelle
- Grey-crowned babbler
- Speckled warbler
- Powerful owl
- Grey-headed flying fox
- Little lorrikeet
- Scarlet robin

FIGURE 5.1

Location of Recorded Threatened Fauna Species

5.1.4 Mammals

A total of 25 mammal species were recorded within the proposed Stage 3 Modification Area. Commonly recorded species included common brush-tail possum (*Trichosurus vulpecula*), eastern grey kangaroo (*Macropus giganteus*) and common wombat (*Vombatus ursinus*).

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*) have been recorded in the Stage 3 Modification area (**Figure 5.1**).

5.2 Habitat Assessment

The Stage 3 Modification Area provides foraging, roosting and nesting habitats for a variety of native fauna. Five broad habitat types occur within the Stage 3 Modification Area, a description of each of these is provided below. A discussion of local and regional habitat connectivity is also given.

5.2.1 Riparian Habitat

Riparian habitats occur along Cony and Quorrobolong Creeks within the Stage 3 Modification Area. Riparian vegetation communities include Swamp Oak Riparian Forest and Riparian Red Gum Forest.

Riparian habitats 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 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.

The riparian vegetation is generally lacking in large hollow-bearing trees and therefore contains little potential habitat for arboreal mammals. However, there are a small number of large, hollow-bearing eucalypts occurring along the stream channel that may provide denning and foraging habitat for arboreal mammals and micro-bats, as well as nesting habitat for a number of bird species.

There are a number of winter-flowering canopy tree species within these habitats, including grey box (*Eucalyptus moluccana*) and forest red gum (*Eucalyptus tereticornis*), which potentially provide resources for winter migrants such as the regent honeyeater (*Anthochaera phrygia*) and the swift parrot (*Lathamus discolor*).

The riparian areas provide important corridors across the local landscape, linking habitats to the south of the Stage 3 Modification Area with those of the north. Within much of the Stage 3 Modification Area these riparian habitats represent the largest refuge for native species and may form important seasonal foraging sites for many species of fauna.

5.2.2 Open Forest Habitat

Open forest habitats occur on the drier slopes and crests in the north of the Stage 3 Modification Area and are represented by the Lower Hunter Spotted Gum – Ironbark Forest. 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 habitats 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 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 (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*).

5.2.3 Derived Grassland Habitat

Much of the Stage 3 Modification 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, some of which are native and some introduced. These areas provide foraging habitat for a range of fauna species, however these are more limited than those of the open forest habitat areas. Amphibian habitat is limited to around farm dams which occur within the Derived Grassland/Pasture (**Section 5.2.4**). The scattered trees that occur throughout the Derived Grassland areas are important refuges for fauna, birds in particular, that use these trees for foraging, and for roost and perch sites.

5.2.4 Constructed Dam Habitat

A number of constructed dams are present across the proposed Stage 3 Modification 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 Modification 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.

5.2.5 Local Habitat Connectivity

Historically, much of the vegetation within the open forest habitats in the northern parts of the Stage 3 Modification Area has been logged and is now predominantly composed of relatively young native vegetation (estimated to be younger than fifty years old). These northern areas are part of a much larger remnant of regrowth native vegetation (now comprising Werakata State Conservation Area and previously the Aberdare State Forest).

A large proportion of the Stage 3 Modification Area is dominated by grassland and pasture. Much of the area has been logged and grazed and continues to be used for agricultural purposes. Consequently, the existing native remnants within the Stage 3 Modification 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 Modification Area.

5.2.6 Regional Habitat Connectivity

The northern parts of the Stage 3 Modification Area form part of the Broken Back Range and some parts have 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 Stage 3 Modification Area or nearby locality.

5.3 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 Stage 3 Modification Area.

Forest red gum (*Eucalyptus tereticornis*) is likely to be hybridising with cabbage gum (*Eucalyptus amplifolia* subsp. *amplifolia*) which also occurs within the Stage 3 Modification 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 other tree species present within the Stage 3 Modification Area which are likely to be koala foraging resources. As such, the Stage 3 Modification 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 Stage 3 Modification Area, there is potential for the koala to utilise the resources of the Stage 3 Modification Area when travelling between adjacent habitats.

Both nocturnal and diurnal searches for koalas were undertaken as part of the original Stage 3 Mine Area surveys (as summarised in **Section 3.1** and in detail in Umwelt 2008b). These searches did not result in the detection of any koalas or evidence of koala occupation such as scats or tree scratches. As such, the Proposed Stage 3 Modification Area is not regarded to be core koala habitat. Therefore, no further consideration of SEPP 44 is required for this project.

5.4 Threatened Fauna Species

The following sections outline the threatened fauna species recorded within the Stage 3 Modification Area and those with potential to occur. **Appendix B** provides a full list of threatened fauna species that were assessed for their potential to occur within the Stage 3 Modification Area.

5.4.1 Recorded Threatened Fauna Species

Twelve threatened fauna species were recorded within the Stage 3 Modification Area; these are listed in **Table 5.1**, along with the survey method by which the species was recorded. All threatened species were recorded during the original Stage 3 assessment (Umwelt 2008b).

Figure 5.1 shows the location where these species were recorded. This table also indicates whether each species has any reasonable potential to be impacted by the Proposed Development, and therefore would require a further assessment of significance. Species with potential to be impacted by the Proposed Development are those that have a dependence on riparian habitats.

Table 5.1 – Threatened Fauna Recorded in the Stage 3 Modification Area

Species	Status	Method of Record	Potential to be Impacted?
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC)	sighted and heard	No
grey-crowned babbler *Pomatostomus temporalis temporalis*	V (TSC)	sighted and heard	No
speckled warbler *Chthonicola saggittatus*	V (TSC)	sighted	No
little lorikeet *Glossopsitta pusilla*	V (TSC)	sighted	No
scarlet robin *Petroica boodang*	V (TSC)	sighted	No
powerful owl *Ninox strenua*	V (TSC)	identification of call during call-playback survey	No
squirrel glider *Petaurus norfolcensis*	V (TSC)	hair analysis and trap capture	No
little bentwing-bat *Miniopterus australis*	V (TSC)	Anabat echolocation analysis	No
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	Anabat echolocation analysis	No
large-footed myotis *Myotis adversus*	V (TSC)	Anabat echolocation analysis	**Yes – significance assessment in Appendix C**
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC)	Anabat echolocation analysis	No
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	Anabat echolocation analysis	No

Notes:

V=vulnerable

TSC = *Threatened Species Conservation Act 1995*

5.4.2 Threatened Fauna Species with *Potential* to Occur

A search of the DECCW and DSEWPC 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 Stage 3 Modification Area. **Appendix B** lists the threatened fauna species recorded from these two database searches, and assesses the likelihood of their occurrence within the Stage 3 Modification Area. A total of 18 threatened fauna species were found to have potential habitat in the Stage 3 Modification Area. All species with potential to occur within the Stage 3 Modification Area are listed in **Table 5.2** below. This table also indicates whether each species has any reasonable potential to be impacted by the Proposed Development, and therefore would require a further assessment of significance. Species

with potential to be impacted by the Proposed Development are those that have a dependence on riparian habitats.

Table 5.2 - Threatened Fauna Species with *Potential* to Occur within the Stage 3 Modification Area

Species	Status	Potential to Occur in Stage 3 Modification Area	Potential to be Impacted?
green-thighed tree frog *Litoria brevipalmata*	V (TSC)	Yes	**Yes – assessed in Appendix C**
little eagle *Hieraaetus morphnoides*	V(TSC)	Yes	No
square-tailed kite *Lophoictinia isura*	V (TSC)	Yes	No
red goshawk *Erythrotriorchis radiatus*	E (TSC) V (EPBC)	Yes	No
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)	Yes	No
swift parrot *Lathamus discolor*	E (TSC) E (EPBC)	Yes	**Yes – Assessed in Appendices C and D**
regent honeyeater *Anthochaera phrygia*	E (TSC) E (EPBC)	Yes	**Yes – Assessed in Appendices C and D**
turquoise parrot *Neophema pulchella*	V (TSC)	Yes	No
barking owl *Ninox connivens*	V (TSC)	Yes	No
masked owl *Tyto novaehollandiae*	V (TSC)	Yes	No
brown treecreeper *Climacteris picumnus victoriae*	V (TSC)	Yes	No
black-chinned honeyeater *Melithreptus gularis gularis*	V (TSC)	Yes	No
diamond firetail *Stagonopleura guttata*	V (TSC)	Yes	No
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V(EPBC)	Yes	**Yes – Assessed in Appendices C and D**
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC)	Yes	No
koala *Phascolarctos cinereus*	V (TSC)	Yes	No
large-eared pied bat *Chalinolobus dwyeri*	V (TSC)	Yes	No
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC)	Yes	No

Key:

TSC = *Threatened Species Conservation Act* 1995

EPBC = *Environment Protection and Biodiversity Conservation Act* 1999

E = Endangered

V = Vulnerable

5.5 Endangered Fauna Populations

There are no endangered fauna populations known to occur or with potential to occur within the Stage 3 Modification Area.

5.6 Critical Habitat

There are no areas of critical habitat occurring within or in proximity to the Stage 3 Modification Area.

5.7 EPBC – Listed Migratory Species

A search of the DSEWPC 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 Stage 3 Modification Area (based on DSEWPC habitat modelling).

The EPBC Act-listed migratory and marine species returned from the DSEWPC database search are listed in **Table 5.3** below, which indicates each species potential to occur in the Stage 3 Modification Area, and the potential to be impacted by the Proposed Development.

Table 5.3 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the Stage 3 Modification Area (DSEWPC Protected Matters Database)

Species	Status	Potential to Occur in Stage 3 Modification Area	Potential to be Impacted?
white-bellied sea-eagle *Haliaeetus leucogaster*	Migratory Marine	Recorded	No
white-throated needletail *Hirundapus caudacutus*	Migratory Marine	Moderate	No
rainbow bee-eater *Merops ornatus*	Migratory Marine	Recorded	No
black-faced monarch *Monarcha melanopsis*	Migratory Marine	Moderate	No
satin flycatcher *Myiagra cyanoleuca*	Migratory Marine	Recorded	No
rufous fantail *Rhipidura ruffifrons*	Migratory Marine	High	No
regent honeyeater *Anthochaera phrygia*	Migratory	High	**Yes – Assessed in Appendix D**
great egret *Ardea modesta*	Migratory Marine	Moderate	**Yes – Assessed in Appendix D**
cattle egret *Ardea ibis*	Migratory Marine	High	**Yes – Assessed in Appendix D**

Table 5.3 - Migratory and listed marine species potentially occurring within a 10 kilometre radius of the Stage 3 Modification Area (DSEWPC Protected Matters Database) (cont)

Species	Status	Potential to Occur in Stage 3 Modification Area	Potential to be Impacted?
Lathams snipe *Gallinago hardwickii*	Migratory Marine	Low	No
painted snipe *Rostratula benghalensis*	Migratory Marine	Low	No
fork-tailed swift *Apus pacificus*	Migratory Marine	Moderate	No
swift parrot *Lathamus discolor*	Marine	High	**Yes – Assessed in Appendix D**

Of the 13 EPBC-listed migratory and marine species shown in **Table 5.3** above, three were recorded during surveys of the Stage 3 Modification Area. Four species were found to have potential to be impacted by the Proposed Development and have been further assessed in **Appendix D**.

6.0 Aquatic Results

The full results of the aquatic assessment undertaken for the original Stage 3 Mine Area assessment are reported in Umwelt (2008). The following paragraphs provide a summary description of the aquatic environment within the Stage 3 Modification Area.

6.1 Aquatic Sampling

A total of 39 taxa of macroinvertebrates were recorded across 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 Sites 3 and 4 had 16 taxa each and Site 2 had 15 taxa.

No freshwater fish species 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 holbrooki*). One species of freshwater turtle was recorded, the Macquarie turtle (*Emydura maquarii*).

6.2 Aquatic Habitat Assessment

The characteristics of the major aquatic habitats of the Stage 3 Modification Area are described in the following sections.

6.2.1 Cony Creek

Cony Creek runs in an east-west direction throughout the centre of the Stage 3 Modification 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 Stage 3 Modification 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.

6.2.2 Sandy Creek

Sandy Creek runs through the south-west corner and along the southern boundary of the Stage 3 Modification 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.

6.2.3 Dam Habitats

There are a number of constructed dams within the Stage 3 Modification Area, the majority of which have little or no fringing vegetation. There is one large dam in the north-east of the Stage 3 Modification Area that supports a moderate diversity of emergent sedges and rushes and some aquatic species. These dams would support a diversity of suitable habitats for macroinvertebrates and waterbirds.

6.3 Threatened Fish Species

No FM Act listed threatened species or endangered populations were recorded within the Stage 3 Modification 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 Stage 3 Modification Area.

7.0 Assessment of Impacts

Section 7.1 below provides a discussion of the predicted impacts of longwall mining in terms of subsidence, surface landform, surface and groundwater hydrology and channel morphology. **Sections 7.2** to **7.7** take into consideration the predictions discussed in **Section 7.1** to determine the potential for the Proposed Development to impact on any threatened species or EECs recorded or with potential to occur in the Stage 3 Modification Area. This assessment is based on the predicted surface flood and drainage information discussed above. Key threatening processes (KTPs) and impacts relating to EPBC Matters of National Environmental Significance are also discussed here.

Section 7.8 provides a discussion of potential impacts associated with the ongoing exploration drilling that is anticipated for the project.

7.1 Subsidence, Flood and Drainage Impacts

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 2005c). 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).

Subsidence predictions provided by MSEC (2011) for the Proposed Development were used by Umwelt to model the flood response in the Proposed Stage 3 Modification Area. The subsidence predictions included both the most likely subsidence and the maximum subsidence that can be reasonably expected as a result of the proposed mining operations. The use of both the most likely and the predicted maximum subsidence allows for the incorporation of some of the uncertainty associated with subsidence modelling into the prediction of the flood impact of the Proposed Development. The modelling tool used by MSEC was calibrated using measured subsidence data from the Branxton Formation from previous mining at the Ellalong mine and Longwalls A1 to A3 from Stages 1 and 2 of the Austar mine.

The following points summarise the key findings of the subsidence modelling (MSEC 2011) and flood modelling (Umwelt 2011b), relevant to ecological values:

- subsidence will occur relatively uniformly over the Stage 3 Modification Area;
- analysis indicates that the Proposed Development will not have a significant impact on the flow regime of the Sandy Creek and Cony Creek systems with only minor changes predicted in runoff regimes and peak discharges compared to that previously approved under Project Approval 08_0111;
- the potential for mining to result in stream capture is considered negligible due to the depth of mining below the ground surface and the geology of the area;
- analysis indicates that there will be no changes to channel alignment as a result of subsidence from the Proposed Development;
- drainage line analysis of the predicted subsided landform indicates that all creek systems will remain free draining without mitigation works;
- ponding at the confluence of Cony Creek and Sandy Creek will be less than that predicted for the original Stage 3 Mine proposal and approved under Project Approval 08_0111;
- there are no discernible changes to in-channel and out of channel ponding (compared with that predicted for original Stage 3 project approved under Project Approval 08_0111), except an area immediately upstream of Quorrobolong Road on Cony Creek, where increased ponding in pasture is predicted;
- average in-channel grade of Cony Creek is predicted to remain at approximately 0.4% and Sandy Creek 0.4-0.5%, indicating that no significant changes in overall stream power or erosive potential along these reaches is expected;
- there are no areas in which subsidence is predicted to result in a reduction in water flow rates or volumes; and
- the potential to increase erosion on the landform is also expected to be minimal due to the relatively small predicted changes in landform grades combined with the relatively low percentage of exposed soils that exist in the area.

Due to the geology of the area, the mine layout and the depth of cover to the coal seam (440 to 750 metres) within the Stage 3 Modification 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 as for the approved Stage 3 Mine development, subsidence will occur reasonably consistently over the breadth of the Stage 3 Modification Area. The proposed changes to the mine plan for Stage 3 are predicted to result in similar, but slightly lower maximum predicted subsidence, tilt and curvature than that approved in Project Approval 08_0111 (MSEC 2011). A reduction in the area of impact (within the 20 mm subsidence contour) is also proposed. As a result the subsidence, flood and drainage predictions are very similar to those documented for the original Stage 3 Mine development (Umwelt 2008a). Consequently, subsidence impacts are not expected to have a significant impact on the ecology of the area.

Given that there will be negligible subsidence impacts on the surface landform, or consequent secondary impacts on flood and drainage as a result of the Proposed Development, the impacts on the overlying natural ecosystems will be very minor. In

addition, due to the depth of cover and relative predicted uniformity of subsidence over the Stage 3 Modification Area, it is predicted that surface mitigation works along drainage channels will not be required and hence disturbance of these areas is not likely to be necessary. Any surface cracking that is observed is expected to be minor in nature and is likely to be naturally filled with alluvial material, or would be able to be remediated using minimal disturbance manual techniques rather than high impact machinery.

As discussed in **Section 2.1.3**, an ecological monitoring program was established for the Stage 2 Mine Area with the aim of monitoring for any impacts on the ecological values of riparian areas that may be associated with longwall mining. Spring and autumn monitoring surveys have been undertaken in 2008, 2009 and 2010. To date, there are no observable impacts on ecological values or channel geomorphology in the Stage 2 mine area, with mining of 1.5 longwall panels completed. Given that the environmental conditions and subsidence predictions for the proposed Stage 3 Modification are similar to those for the Stage 2 mining, similar outcomes are expected for the Stage 3 Modification.

7.2 Impacts on Threatened Flora Species

Two threatened flora species were recorded within the Stage 3 Modification Area, heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Both of these species occur on the drier slopes and ridges of the Stage 3 Modification Area in Lower Hunter Spotted Gum – Ironbark Forest. For these species, a 7 part test of significance in accordance with the EP&A Act is provided in **Appendix C** and an assessment under the EPBC Act guidelines is provided in **Appendix D**. Although 7 part tests of significance are not strictly required for developments assessed under Part 3A (it is a tool for assessments under Part 5A), 7 part tests are nevertheless used as the means of determining the likely level of significance of impacts in this instance in the absence of any other formal guidelines for such assessments.

Table 4.2 indicates five additional species which have potential to occur in the Stage 3 Modification Area. The predictions indicate that there will be no impacts associated with longwall mining that could result in the significant alteration of surface landforms, vegetation or habitats. The impacts are expected to be very minor and focused in riparian environments. All five threatened flora species with potential to occur in the Stage 3 Modification Area occupy drier environments on slopes and ridges and would not occur in the riparian environments of the Stage 3 Modification Area. As such, there is no reasonable potential for any of these potentially occurring threatened flora species to be impacted by the Proposed Development.

7.3 Impacts on EECs

Two EECs were recorded within the Stage 3 Modification Area, the River-flat Eucalypt Forest EEC and the Lower Hunter Spotted Gum – Ironbark Forest EEC.

The subsidence predictions indicate that there will be no impacts associated with longwall mining that could result in the significant alteration of surface landforms, vegetation or habitats. The impacts are expected to be very minor and focused in riparian environments. Along Cony Creek where the River-flat Eucalypt Forest EEC occurs, the channel is very well defined and therefore there will be negligible changes to hydrology in terms of flow rates and volume, and there is no predicted out of channel ponding.

The significance of any potential impacts on the River-flat Eucalypt Forest EEC and the Lower Hunter spotted Gum – Ironbark Forest is assessed through a 7 part test in accordance

with the requirements of the EP&A Act. Although 7 part tests of significance are not strictly required for developments assessed under Part 3A (it is a tool for assessments under Part 5A), 7 part tests are nevertheless used as the means of determining the likely level of significance of impacts in this instance in the absence of any other formal guidelines for such assessments. This assessment, provided in **Appendix C**, concludes that the Proposed Development will not have a significant impact on the River-flat Eucalypt Forest or Lower Hunter Spotted Gum – Ironbark Forest EECs such that it would place the local occurrence of the EECs at risk of extinction.

7.4 Impacts on Threatened Fauna Species

Twelve threatened fauna species were recorded within the Stage 3 Modification Area, while 18 were found to have potential to occur (**Table 5.2**).

The predictions indicate that there will be no impacts associated with longwall mining that could result in the significant alteration of surface landforms, vegetation or habitats. The impacts are expected to be very minor and focused in riparian environments only. The majority of threatened fauna species recorded or with potential to occur in the Stage 3 Modification Area occupy and/or utilise drier environments on slopes and ridges and would not occur in the riparian environments of the Stage 3 Modification Area. As such, there is no reasonable potential for these threatened fauna species to be impacted by the Proposed Development.

However, there are five threatened fauna species which potentially utilise the riparian habitats of the Stage 3 Modification Area for foraging resources, and as such could be impacted by the Proposed Development. These species are the grey-headed flying-fox (*Pteropus poliocephalus*) (potentially occurring), large-footed myotis (*Myotis adversus*) (recorded), the green-thighed frog (*Litoria brevipalmata*) (potential), regent honeyeater (*Anthochaera phrygia*) (potential) and the swift parrot (*Lathamus discolor*) (potential).

A 7 part test of significance, in accordance with the requirements of the EP&A Act, has been prepared only for the five threatened fauna species (listed above) which were found to have reasonable potential to be impacted upon by the Proposed Development (**Appendix C**). Although 7 part tests of significance are not strictly required for developments assessed under Part 3A (it is a tool for assessments under Part 5A), 7 part tests are nevertheless used as the means of determining the likely level of significance of impacts in this instance in the absence of any other formal guidelines for such assessments.

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

The grey-headed flying-fox (*Pteropus poliocephalus*), regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*) are also listed on the EPBC Act. An assessment in accordance with the requirements of the EPBC Act is provided for these species in **Appendix D**. This assessment also concludes that there will be no significant impact on these species as a result of the Proposed Development.

7.5 Impacts on Endangered Populations

There are no endangered flora or fauna populations present within the Stage 3 Modification Area, therefore there will be no impacts on endangered populations as a result of the Proposed Development.

7.6 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 Stage 3 Modification 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 Stage 3 Modification Area.	No World Heritage properties will be impacted upon as a result of the Proposed Development.
The national heritage values of places on the National Heritage List.	There are no National Heritage Listed places within the Stage 3 Modification Area. Nearby Natural Heritage listed places include Bow Wow Creek Gorge and Mulbring Road-Fill Quarry.	No National Heritage Listed places will be impacted upon as a result of the Proposed Development.
The ecological character of declared Ramsar wetlands.	The Stage 3 Modification Area lies within the same catchment as the Hunter Estuary Wetlands Ramsar site, however it is a considerable distance upstream of this.	The Proposed Development will not impact on the ecological character of any Ramsar wetland site.
Threatened species (other than extinct and conservation-dependent species) and ecological communities (other than vulnerable ecological communities) listed under the EPBC Act.	Two EPBC Act listed threatened species were recorded within the Stage 3 Modification Area, and a number have potential to occur. Five EPBC Act listed threatened species (refer to **Sections 7.2** and **7.4**) required further assessment under the Act.	An assessment under the Act is provided in **Appendix D** which concludes there is no potential for a significant impact on any EPBC Act listed threatened species.
Migratory species listed under the EPBC Act.	A number of EPBC Act listed migratory bird species have potential to occur within the Stage 3 Modification Area. Four EPBC Act listed migratory species required further assessment under the Act.	An assessment of significance prepared for those four species is provided in **Appendix D** and concludes there will be no significant impact on any EPBC Act listed migratory species.

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

MNES	Potential to Occur within the Stage 3 Modification Area	Potential for Significant Impact
Nuclear actions that are likely to have a significant impact on the environment.	The Proposed Development does not involve any nuclear actions.	The Proposed Development does not involve any nuclear actions that may have a significant impact on the environment.
The Commonwealth marine environment.	The Stage 3 Modification Area is not within the Commonwealth marine environment.	The Proposed Development will not have a significant impact on any areas of the Commonwealth marine environment.

In summary, from **Table 7.1** the Proposed Development 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.

7.7 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.

7.7.1 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.

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 2005c).

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 2005c). Of those species listed, one was recorded within the Stage 3 Modification Area, the large-footed myotis (*Myotis adversus*) and the grey-headed flying-fox (*Pteropus poliocephalus*) potentially occurs.

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 that subsidence will occur reasonably consistently over the breadth of the Stage 3 Modification Area, the Proposed Development will result in similar, but slightly lower

maximum predicted subsidence, tilt and curvature than that approved in Project Approval 08_0111 (MSEC 2011), and the very low potential for any increase or decrease in surface water ponding (within riparian areas or elsewhere) or other hydrological alterations, there will be no impact on any threatened fauna species.

Appropriate management measures will be implemented in the event that the underground mining results in unforeseen threats to the ecological values of the Stage 3 Modification 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 Development will involve underground mining, there will be no clearing of native vegetation required for the Stage 3 Modification Area. Subsidence (and impacts resulting from subsidence), are not expected to result in the loss of any vegetation.

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

There is very limited potential that operations associated with the Proposed Development would introduce exotic perennial grasses into native plant communities. Should monitoring of the Stage 3 Modification Area 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 Development would cause an increase in the frequency of fire in areas of native vegetation. In the event that the vegetation of the Stage 3 Modification 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 Development, there is potential for minor (localised and short term) alterations to the natural flow regime of the underlying waterways. There is potential for a slight increase in natural ponding on Cony Creek upstream of Quorrobolong Road resulting from the Stage 3 modification. In addition there is potential for a decrease in ponding at the confluence of Sandy Creek and Cony Creek compared to that predicted for the original proposal approved under project approval 08_0111. Overall the Stage 3 modification will result in less ponding impact compared to that approved under project approval 08_0111. 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 Stage 3 Modification Area.

7.7.2 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 Development will involve underground mining, there will be no clearing of native vegetation required in the Stage 3 Modification Area.

7.7.3 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 Development is expected to have negligible potential to cause degradation of riparian vegetation as a result of subsidence. The predicted levels of subsidence for the Proposed 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.

7.8 Exploration Drilling

The magnitude of exploration drilling required over the life of the project cannot be quantified, however will be necessary to continually refine the Stage 3 mine plan as mining progresses. The area of impact of each exploration site is generally small (20 metres by 20 metres), and would require clearing of surface vegetation (if present) within the area. This impact assessment does not take into consideration any impacts associated with exploration drilling and therefore such practices require treatment and assessment separately. **Section 8** outlines the management measures that will be undertaken to ensure that the impacts of ongoing exploration drilling are kept to a minimum and that if significant ecological values (threatened ecological communities and threatened species and their habitats) have potential to be disturbed, that impact is appropriately assessed and managed.

7.9 Summary of Impacts

Subsidence as a result of the Proposed Development will occur reasonably consistently over the breadth of the Stage 3 Modification Area, and the Proposed Development will result in similar, but slightly lower maximum predicted subsidence, tilt and curvature than the original Stage 3 Mining Area approved in Project Approval 08_0111 (MSEC 2011). The Proposed Development is not predicted to result in significant changes to the surface and groundwater patterns within the Stage 3 Modification Area, and therefore the potential for impacts on the vegetation and habitats is very low. It is expected that there will be no loss of or modification to any vegetation community in the Stage 3 Modification Area. As such, there will be no significant impact on any recorded or potentially occurring threatened species, populations or TECs.

As a precautionary measure, a 7 part test of significance in accordance with the requirements of the EP&A Act was undertaken for the River-flat Eucalypt Forest EEC, the Lower Hunter Spotted Gum – Ironbark Forest EEC, heath wrinklewort (*Rutidosis heterogama*), small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), green-thighed frog (*Litoria brevipalmata*), swift parrot (*Lathamus discolor*), regent honeyeater (*Anthochaera phrygia*), grey-headed flying-fox (*Pteropus poliocephalus*) and the large-footed myotis (*Myotis adversus*). The EECs and the threatened fauna species occupy or rely heavily on riparian habitats, and therefore are at greater risk of being impacted by the Proposed Development than any other species. The outcomes of the 7 part tests conclude that there

would not be a significant impact on any threatened species, populations or TECs as a result of the Proposed Development.

Three threatened fauna species and four migratory species listed under the EPBC Act were found to have potential to be impacted by the Proposed Development, and therefore required 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*), swift parrot (*Lathamus discolor*), regent honeyeater (*Anthochaera phrygia*), great egret (*Ardea modesta*) and cattle egret (*Ardea ibis*) is provided in **Appendix E**. This concludes that there will be no significant impact on any of these species as a result of the Proposed Development.

8.0 Ecological Management and Monitoring

The impacts of the proposed Stage 3 Modification are not significantly different to those documented in the original Stage 3 Mining Area assessment (Umwelt 2008a). As such, the monitoring and management measures documented in the original Stage 3 assessment (Umwelt 2008a) are appropriate and are proposed for the Stage 3 Modification project. The details of the proposed monitoring measures are provided in the following sections. This includes a discussion of the process that will be followed for future exploration drilling works.

8.1 Ecological Monitoring

Although the predicted disturbances suggest that there will be no significant impact on any recorded or potentially occurring threatened species, endangered population or TEC as a result of the Proposed Development, ongoing monitoring will be undertaken as mining proceeds to ensure that any actual impacts are discovered quickly and managed appropriately. In the event that monitoring does reveal impacts, modifications to the project and mitigation measures where appropriate will be implemented accordingly. In addition, monitoring will ensure that any mitigation measures recommended are successfully implemented.

A summary of the monitoring and remediation process is provided in **Diagram 1**.

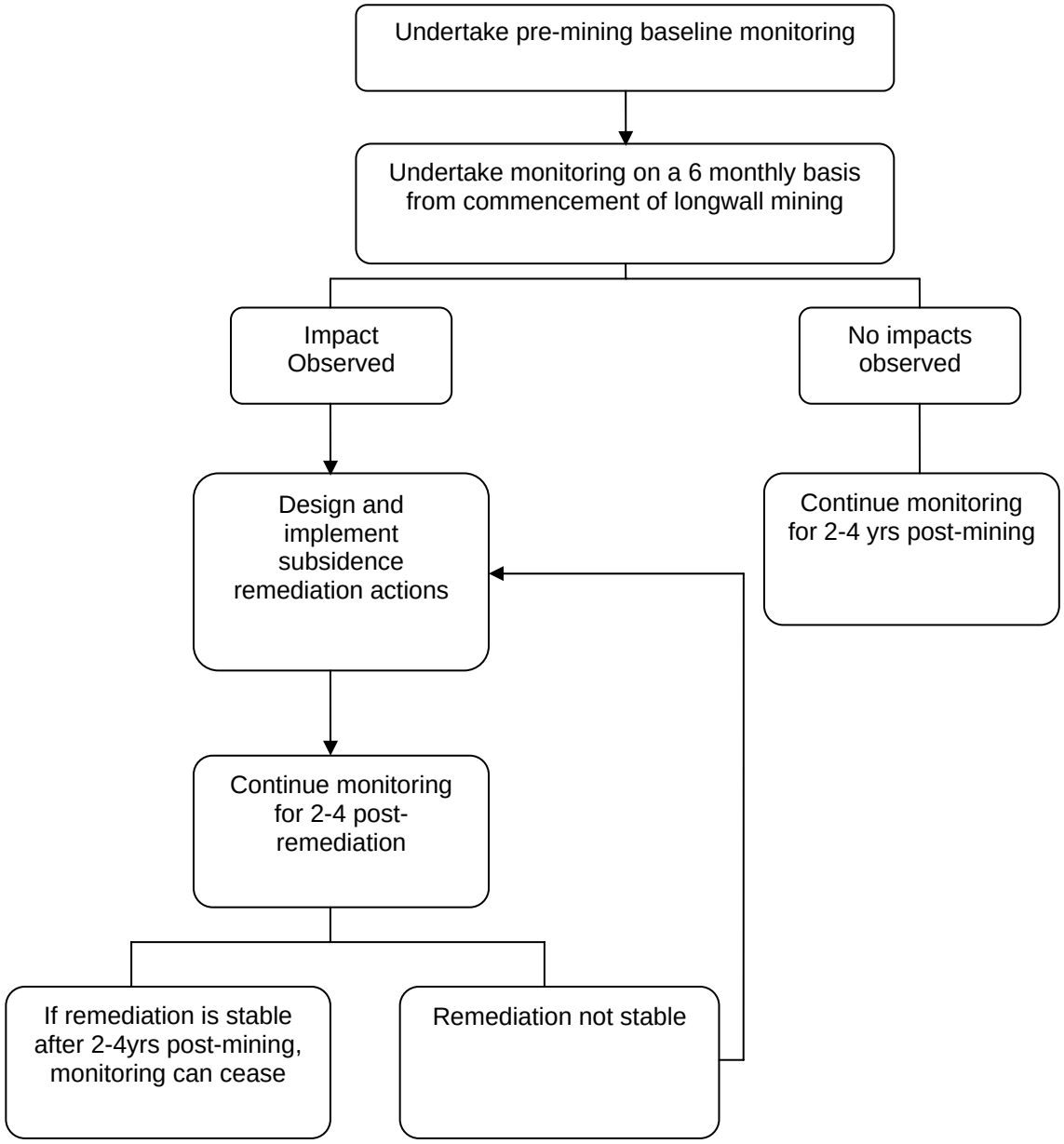


Diagram 1 – Summary of Monitoring and Rehabilitation Program Steps

The monitoring program for the Stage 3 Modification Area will be consistent with the Stage 2 monitoring methods where appropriate. A detailed Monitoring Program should be developed for the site outlining specifics of the program such as site location, survey methods and a schedule of monitoring. The monitoring will specifically focus on riparian habitats, as this is where any potential impacts from longwall mining subsidence are most likely to occur, however there will also be monitoring situated in non-riparian areas, in particular within the Lower Hunter Spotted Gum – Ironbark Forest EEC which occurs on the drier slopes and ridges of the Stage 3 Modification Area.

Monitoring will be undertaken on a bi-annual basis, preferably with one survey in autumn and one in spring. One baseline survey in both seasons should be undertaken at all sites prior to the commencement of mining. The cessation of monitoring will be linked with the results of the subsidence monitoring. That is, when the subsidence monitoring reveals that there is no longer any significant ground movement, monitoring will continue for a period of two to four years. This timeframe for completion of monitoring is indicative only, as it will depend

strongly on whether any impacts are observed and whether remediation works are required. Monitoring will need to continue for a longer period of time if remediation works are required or if changes to the ecological values are observed, in which case monitoring will continue until the condition of the site is found to be stable.

It is intended that the monitoring sites will be added to and removed from the program progressively as mining proceeds. For example, sites influenced by Longwall 8 will be monitored for baseline data 12 months prior to the mining of that longwall, and should continue after the mining of that longwall. As stated above, monitoring should continue 2-4 years from when subsidence monitoring reveals a stabilisation of ground movement.

The monitoring program will incorporate three key survey methods: permanent vegetation plots; vegetation condition assessment; and photo monitoring. Specific surveys targeting fauna groups is not deemed necessary given the minimal surface disturbances predicted and the extensive effort required to collect sufficient data on fauna species to allow reliable comparisons to be made. Should the results of monitoring surveys reveal sufficient reason to conduct fauna surveys, the monitoring program should be appropriately adapted.

8.2 Management of Subsidence Remediation

Remediation works will be undertaken if monitoring reveals there has been an impact resulting from subsidence; for example bank slumping, vegetation dieback or increased water ponding. The impact will be assessed by relevant experts including engineers and ecologists, and the most appropriate management action will be developed. Where possible, any remediation works will aim for minimum disturbance to existing vegetation and habitats. If revegetation works are required, only locally occurring, native species appropriate to the site should be used. Monitoring of the remediation works should continue until they are deemed successful and stable.

8.3 Management of Exploration Drilling

As described in **Section 7.8**, exploration drilling will need to be undertaken throughout the life of the project. Given that the number and locations of the boreholes cannot be predetermined, the impacts of the drilling are not assessed under the impact assessment in this document. As such, the following guidelines have been developed for the conducting of exploration drilling works. The purpose of these guidelines is to protect and minimise harm to areas of ecological significance, in particular EECs and threatened species habitats.

In relation to all exploration drilling works, the following guidelines must be adhered to:

Grassland Areas

- Preliminary placement of boreholes should target cleared areas or areas of 'Derived Grassland', where the risk of potential impacts on ecological values (threatened species, endangered populations, TECs and important habitat features such as hollows and nests) are significantly lower than in riparian or forested areas. No further ecological assessment would be required in this case (assuming that no mature trees are required to be disturbed).

Riparian and Forested Areas

- In riparian or forested areas, due diligence inspections of all borehole sites should be conducted by a suitably qualified ecologist prior to any disturbance. The inspections

should determine whether any areas of an EEC, threatened species habitat or any other significant ecological feature falls within the proposed disturbance footprint, including any access tracks to be constructed for drill access (if required).

- If any significant ecological feature (as listed above) is identified within the footprint of a proposed borehole, the borehole should be relocated to a more suitable location where possible to avoid impacts on ecological values.

- If the borehole cannot be relocated and will result in disturbance to any significant ecological feature, an appropriate process for assessment and mitigation of impacts will be undertaken prior to any disturbance to the site.

- All borehole sites will be remediated following disturbance, including reapplication of topsoil and spreading with locally native seeds appropriate to the community in which the disturbance has occurred. Any vegetation removed will be left in-situ to contribute to ground habitats.

8.4 Preparation of an Ecological Management Plan

In accordance with commitment 1.4.4 of Project Approval 08_0111 for the original Stage 3 Mine project, an Austar Mine Complex Ecological Management Plan will be prepared. The aim of this plan is to integrate management of ecological issues associated with the construction of the SIS, Stage 3 underground mining and the remainder of the Austar Coal Mine operations. This plan will be submitted to the Director-General for approval, prior to the commencement of the construction of buildings at the SIS, or second workings in the Stage 3 Area.

The conditions state that the Ecological Management Plan should include:

- clearing procedures for establishment of the SIS and associated access road/services easement;

- replacement of arboreal habitat within surrounding areas or within the Biodiversity Offset Area, should the removal of any hollow-bearing trees be required; and

- extension of the existing Austar Coal Mine ecological monitoring program to include monitoring of vegetation condition within the subsidence affected areas.

The Ecological Management Plan as committed to in Project Approval 08_0111 is considered appropriate to manage ecological issues in the Stage 3 Modification Area, and will draw on and expand on the recommendations provided in this ecological assessment.

9.0 Abbreviations

ASL	Above sea level
Austar	Austar Coal Mine
DECCW	Department of Environment, Climate Change and Water
DGRs	Director-General's Requirements
DoP	Department of Planning
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EA	environmental assessment
EECs	endangered ecological communities
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth)
EPL	Environment Protection Licence
FM Act	Fisheries Management Act 1994 (NSW)
ha	hectares
KTP	key threatening process
LHCCREMS	Lower Hunter and Central Coast Regional Environmental Management Strategy
LGA	Local Government Area
LW	longwall
m	metres
m^2	metres squared
mm	millimetres
MNES	Matters of National Environmental Significance
MSEC	Mine Subsidence Engineering Consultants Pty Ltd
NPWS	National Parks and Wildlife Service
OEH	Office of Environment and Heritage
ROTAP	rare or threatened Australian plant

SEPP	State Environmental Planning Policy
SIS	Surface Infrastructure Site
TEC	Threatened Ecological Community
TSC Act	Threatened Species Conservation Act 1995 (NSW)
Umwelt	Umwelt (Australia) Pty Limited

10.0 References

Anstis, M (2002) Tadpoles of South-eastern Australia. Reed New Holland, Sydney.

Australian Museum Online, 2005, Birds in Backyards, *Bird Finder*. http://www.birdsinbackyards.net/finder/index.cfm (accessed 2011)

Austin, M P, Cawsey, E M, Baker, B L, Yialeloglou, M M, Grice, D J and Briggs, S V (2000) *Predicted Vegetation Cover in the Central Lachlan Region. Final report of the Natural Heritage Trust Project AA 1368.97*. CSIRO Wildlife and Ecology, Canberra.

Barker, J., Grigg, G. C. & Tyler, M. J. (1995) *A Field Guide to Australian Frogs*. Surrey Beatty & Sons, Sydney.

Bedward, M., Keith, D and Pressey, R (1992) Homogeneity analysis: assessing the utility of classifications and maps of natural resources. *Australian Journal of Ecology* 17:133-140.

Belbin, L (1995a) *PATN Analysis Package: Users Guide*. CSIRO Division of Wildlife Rangelands Research, Canberra.

Belbin, L (1995b) *PATN Pattern Analysis Package: Reference Manual*. CSIRO Division of Wildlife Research, Canberra.

Bell, S (2004) Vegetation of Werakata National Park, Hunter Valley, New South Wales. *Cunninghamia 8*(3): 331-347.

Bell, S A J and Driscoll, C (2008) Vegetation of the Cessnock-Kurri Region, Cessnock LGA, New South Wales: Survey, Classification & Mapping. Prepared for the Department of Environment and Conservation, Newcastle.

Botanic Gardens Trust (2011) *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <http://plantnet.rbgsyd.nsw.gov.au> accessed January 2011.

Braun-Blanquet, J (1927) *Pflanzensoziologie*. Springer, Vienna.

Briggs, J.D. and Leigh, J.H (1996) *Rare or Threatened Australian Plants*. CSIRO, Canberra.

Churchill, S (1998) Australian Bats. Reed New Holland, Sydney.

Cogger, H G (2000) Reptiles & Amphibians of Australia. Reed, Chatswood.

Cronquist, A (1981) *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.

DEC (2005) *The Vertebrate fauna of Werakata National Park.* Unpublished report funded by the Central Branch Parks and Wildlife Division Biodiversity Survey Priorities Program by NSW Department of Environment and Conservation, Information and Assessment Section, Metropolitan Branch, Environment Protection and Regulation Division.

Department of Environment, Climate Change and Water NSW (2009) Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Prepared by Dr Peggy Eby.

Department of Environment and Climate Change (DECCW) 2011
Threatened Species – Species Populations & Ecological Communities of NSW, Sydney, Australia <http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/home_species.aspx > Accessed 2011

Department of Environment, Water, Heritage and the Arts (DEWHA), 2011
Species Profile and Threats Database, Canberra, Australia <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl> accessed 2011

Department of Natural Resources and Environment (1999) Regent Honeyeater (*Xanthomyza phrygia*) Recovery Plan 1999 – 2003.

Ecotone Ecological Consultants (1995) *Survey of Non-flying mammals and owls and impact assessment of forestry practices in Morisset Forestry District.* Morisset Forestry District Environmental Impact Statement. Supporting Document No. 9. State Forests of NSW, Sydney.

ERM, (2006) Longwall Panels A1 and A2 Flora and Fauna Assessment, prepared for Austar Coal Pty Limited, April 2006.

Harden, G (2002) *Flora of New South Wales*, Volume 2, Revised edition, NSW University Press, Australia.

Harden, G (2000) *Flora of New South Wales*, Volume 1, Revised edition, NSW University Press, Australia.

Harden, G (1993) *Flora of New South Wales*, Volume 4, NSW University Press, Australia.

Harden, G (1992) *Flora of New South Wales*, Volume 3, NSW University Press, Australia.

HLA (1995) EIS – Ellalong Colliery Extension into Bellbird South, Volume 2, Flora and Fauna Assessment. Prepared by HLA Envirosciences on behalf of Newcastle Wallsend Coal Company.

House, S (2003) Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy, Technical Report, Digital Aerial Photo Interpretation and Updated Extant Vegetation Community Map, May 2003. Lower Hunter and Central Coast Regional Environmental Management Strategy, Callaghan, NSW.

Hoye, G (1995) *A Bat Survey of the Morisset Forestry District.* Morisset Forestry District Environmental Impact Statement, Supporting Document No. 5 State Forests of NSW, Sydney.

Kovac, M and Lawrie, J (1991) Soil Landscapes of the Singleton 1:250,000 Sheet. Soil Conservation Service of NSW, Sydney.

Menkhorst, P. and Knight, F. (2004) *A field guide to the Mammals of Australia*, Oxford University Press, South Melbourne.

Mine Subsidence Engineering Consultants (MSEC), 2011. *Report on the Prediction of Subsidence Parameters and the Assessment of Mine Subsidence Impacts on Natural Features and Surface Infrastructure Resulting from the Extraction of the Proposed Longwalls A7 to A19 in Stage 3 of the Austar Coal Mine*. Report prepared for Austar Coal Mine Pty Limited.

NSW Government (2011) *BioNet*, Search and Map Species.
<http://www.bionet.nsw.gov.au/Area.cfm> accessed 2011

New South Wales National Parks and Wildlife Service (NPWS) (2000) *Vegetation Survey, Classification and Mapping: Lower Hunter and Central Coast Region. Version 1.2.* A Project undertaken for the Lower Hunter and Central Coast Regional Environment Management Strategy. Sydney Zone, NPWS, Hurstville.

NSW Scientific Committee (2005a) River-flat Eucalypt Forest in the NSW North Coast, Sydney Basin and South-east Corner Bioregions – endangered ecological community listing – NSW Scientific Committee Final Determination.

NSW Scientific Committee (2005b) Lower Hunter Spotted-gum – Ironbark Forest in the Sydney Basin Bioregion – endangered ecological community listing – NSW Scientific Committee Final Determination.

NSW Scientific Committee (2005c) Alteration of habitats as a result of subsidence due to longwall mining, Key Threatening Process – NSW Scientific Committee Final Determination.

Peake, T C, Bell, S A J, Tame, T M, Simpson, J A and Curran, T J (2003) The Hunter Rare Plants Database: Identification and Listing of Regionally Significant Flora for the Hunter Region, New South Wales. Poster at Ecological Society of Australia Conference, Armidale, December 2003.

Poore, M, E, D (1955) The use of phytosociological methods in ecological investigations. I. The Braun-Blanquet system. *Journal of Ecology* 42: 216-224.

Robinson, M (1998) A Field Guide to Frogs of Australia. Australian Museum/Reed New Holland, Sydney.

Scotts, D. (2003) *Key Habitats and Corridors for Forest Fauna: A Landscape Framework for Conservation in North-east New South Wales*, NSW NPWS Occasional Paper 32, NSW National Parks and Wildlife Service, Sydney.

Slater, P, Slater, P and Slater, R (2003) *The Slater Field Guide to Australian Birds*. Weldon Publishing, Sydney.

Speight JG (1990) Landform. In: 'Australian soil and land survey. Field handbook' Second edition (Eds. RC McDonald, RF Isbell, JG Speight, J, Walker, MS Hopkins), pp9-57. Inkata Press, Melbourne.

Strahan, R (2002) The Mammals of Australia. Australian Museum – Reed New Holland, Sydney.

Swan, G., Shea, G. & Sadlier, R (2004) *A Field Guide to Reptiles of New South Wales*. Reed New Holland, Sydney.

Swift Parrot Recovery Team (2001) Swift Parrot Recovery Plan, Department of Primary Industries, Water and Energy, Hobart.

Umwelt (Australia) Pty Limited (2007) Austar Stage 2 Subsidence Management Plan – Appendix 1 Ecological Assessment, February 2007. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt (Australia) Pty Limited (2008a) Austar Coal Mine Project – Stage 3 Environmental Assessment. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt Australia Pty Limited (2008b) Austar Ecological Assessment, Stage 3 Mine Area, (Longwalls 6 to 17), and Surface Infrastructure Site, September 2008. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt Australia Pty Limited (2009) Baseline Ecological Monitoring Report for Stage 2 Longwalls, Austar Mine, Quorrobolong, June 2009. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt Australia Pty Limited (2010) 2009 Ecological Monitoring Report for Stage 2 Longwalls, Austar Coal Mine, Quorrobolong NSW, March 2010. Prepared on behalf of Austar Coal Mine Pty Limited.

Umwelt Australia Pty Limited (2011a) 2010 Ecological Monitoring Report for Stage 2 Longwalls, Austar Coal Mine, Quorrobolong NSW.

Umwelt (Australia) Pty Limited (2011b) Austar Coal Mine Flood and Drainage Assessment: Stage 3 Modification. Prepared on behalf of Austar Coal Mine Pty Limited.

Webster, R (1995) *Fauna Survey of the Morisset Forestry District Central Region Diurnal Birds*. Morisset Forestry District Environmental Impact Statement – Supporting Document No. 6. State Forests of NSW, Sydney.

Wellington, R and Wells, R (1995) *Fauna Survey of the Morisset Forestry District Central Coast, NSW Reptiles and Amphibians*. Morisset Forestry District Environmental Impact Statement – Supporting Document No. 7. State Forests of NSW, Sydney.

Wheeler, D J B, Jacobs, S W L and Whalley, R, D, B (2002) *Grasses of New South Wales*. 3rd edition. The University of New England, Armidale.

Wilson, S and Swan, G (2003) *A Complete Guide to Reptiles of Australia*. Reed New Holland, Sydney.

Weigel, J (1990) *Australian Reptile Park's Guide to Snakes of South-East Australia*. Weigel Postscript.

APPENDIX A

Flora Species List

Appendix A – Flora Species List

The following list was developed from surveys as detailed in Section 3.0 of the main report. It includes all species of vascular plants observed in the original Stage 3 Mine Area (as reported in Umwelt 2008b) as well as the proposed Stage 3 Modification Area in which supplementary surveys were undertaken for the current assessment. As the proposed Stage 3 Modification Area overlaps with most of the original Stage 3 Mine Area, many of the species recorded for Umwelt (2008b) would also be present in the Stage 3 Modification Area.

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; and
poss.	specimens for which identification was considered likely but not definite.

The following abbreviations or symbols may be used in the list:

asterisk (*)	denotes species not indigenous to the Stage 3 Modification Area;
subsp.	subspecies;
var.	variety;
f.	forma; and
X	hybrid.

Note: 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 2011), 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	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Cycadopsida (cycads)				
Zamiaceae	*Macrozamia communis*	burrawang		x
Zamiaceae	*Macrozamia flexuosa*	a burrawang		x
Filicopsida (ferns)				
Adiantaceae	*Adiantum aethiopicum*	common maidenhair fern	x	x
Adiantaceae	*Cheilanthes distans*	bristly cloak fern		x
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi*	poison rock fern	x	x
Azollaceae	*Azolla pinnata*	ferny azolla	x	x
Blechnaceae	*Doodia aspera*	prickly rasp fern		x
Blechnaceae	*Doodia linearis*	small rasp fern		x
Dennstaedtiaceae	*Pteridium esculentum*	bracken	x	x
Marsileaceae	*Marsilea mutica*	nardoo	x	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	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	*Lepidosperma laterale*		x	x
Dioscoreaceae	*Dioscorea transversa*	native yam		x
Hydrocharitaceae	*Ottelia ovalifolia*	swamp lily		x
Iridaceae	**Romulea rosea*	onion grass	x	x
Juncaceae	**Juncus acutus* subsp. *acutus*	sharp rush		x
Juncaceae	*Juncus usitatus*	common rush	x	x
Juncaginaceae	*Triglochin procerum*	water ribbons	x	x
Lemnaceae	*Wolffia* sp.			x
Lomandraceae	*Lomandra confertifolia*	mat rush		x
Lomandraceae	*Lomandra confertifolia* subsp. *pallida*	mat rush		x
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	wattle mat-rush		x
Lomandraceae	*Lomandra longifolia*	spiny-headed mat-rush	x	x
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	many-flowered mat-rush		x
Lomandraceae	*Lomandra obliqua*	fishbones		x
Luzuriagaceae	*Eustrephus latifolius*	wombat berry	x	x
Luzuriagaceae	*Geitonoplesium cymosum*	scrambling lily		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
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
Phormiaceae	*Dianella longifolia* var. *stenophylla*	blueberry lilly		x
Phormiaceae	*Dianella* sp.			x
Poaceae	*Aristida* sp.	a speargrass		x
Poaceae	*Aristida vagans*	threeawn speargrass		x
Poaceae	*Austrodanthonia caespitosa*	ringed wallaby grass		x
Poaceae	*Austrodanthonia* sp.	a wallaby grass		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
Poaceae	*Echinopogon ovatus*	forest hedgehog grass		x
Poaceae	**Ehrharta erecta*	panic veldtgrass	x	x
Poaceae	*Entolasia marginata*	bordered panic		x
Poaceae	*Entolasia stricta*	wiry panic		x
Poaceae	*Eragrostis leptostachya*	paddock lovegrass		x
Poaceae	*Eragrostis* sp.	a lovegrass		x
Poaceae	*Imperata cylindrica* var. *major*	blady grass	x	x
Poaceae	*Microlaena stipoides* var. *stipoides*	weeping grass	x	x
	Oplismenus aemulus	basket grass		X
Poaceae	*Panicum simile*	two-colour panic		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Poaceae	*Panicum* sp.			x
Poaceae	**Pennisetum clandestinum*	kikuyu grass	x	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
Typhaceae	*Typha orientalis*	broad-leaved cumbungi		x
Xanthorrhoeaceae	*Xanthorrhoea* sp.	a grass tree		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	*Trachymene incisa* subsp. *incisa*			x
Apiaceae	*Xanthosia pilosa*	woolly xanthosia		x
Apocynaceae	*Parsonsia straminea*	common silkpod	x	x
Asclepiadaceae	**Gomphocarpus fruticosus*	narrow-leaved cotton bush		x
Asteraceae	*Ambrosia* sp.	a lacy ragweed	x	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	x
Asteraceae	**Facelis retusa*		x	x
Asteraceae	**Gamochaeta americana*	cudweed	x	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
Asteraceae	***Rutidosis heterogama***	**heath wrinklewort**		**x**
Asteraceae	**Senecio madagascariensis*	fireweed	x	x
Asteraceae	*Sigesbeckia orientalis* subsp. *orientalis*	Indian weed		x
Asteraceae	**Silybum marianum*	variegated thistle		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Asteraceae	**Sonchus oleraceus*	common sowthistle	x	x
Asteraceae	**Taraxacum officinale*	dandelion	x	x
Asteraceae	*Vernonia cinerea* var. *cinerea*			x
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	wonga wonga vine		x
Brassicaceae	*Lepidium bonariense*	cut-leaf peppercress	x	x
Cactaceae	*Opuntia stricta* var. stricta	prickly pear		x
Campanulaceae	*Wahlenbergia gracilis*	sprawling or Australian bluebell		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	x
Caryophyllaceae	*Stellaria pungens*	prickly starwort		x
Casuarinaceae	*Allocasuarina littoralis*	black sheoak		x
Casuarinaceae	*Allocasuarina torulosa*	forest oak		x
Casuarinaceae	*Casuarina glauca*	swamp oak	x	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
Dilleniaceae	*Hibbertia linearis*	a Guinea flower		
Dilleniaceae	*Hibbertia pedunculata*	a Guinea flower		x
Droseraceae	*Drosera peltata*	sundew		x
Elaeocarpaceae	*Elaeocarpus obovatus*	hard quandong		x
Ericaceae (Styphelioideae)	*Acrotriche divaricata*	ground berry		x
Ericaceae (Styphelioideae)	*Astroloma humifusum*	native cranberry		x
Ericaceae (Styphelioideae)	*Lissanthe strigosa*	peach heath		x
Ericaceae (Styphelioideae)	*Melichrus urceolatus*	urn heath	x	

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Ericaceae (Styphelioideae)	*Styphelia triflora*	pink five-corners		x
Euphorbiaceae	*Breynia oblongifolia*	coffee bush	x	x
Euphorbiaceae	*Phyllanthus gunnii*	shrubby spurge		
Euphorbiaceae	*Phyllanthus hirtellus*	thyme spurge		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*			
Fabaceae (Faboideae)	*Daviesia genistifolia*	broom bitter pea		x
Fabaceae (Faboideae)	*Daviesia ulicifolia* subsp. *ulicifolia*	gorse bitter pea	x	x
Fabaceae (Faboideae)	*Desmodium gunnii*	slender tick-trefoil		x
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	rusty tick-trefoil		x
Fabaceae (Faboideae)	*Desmodium varians*	slender tick-trefoil	x	x
Fabaceae (Faboideae)	*Dillwynia retorta*	eggs and bacon		x
Fabaceae (Faboideae)	*Glycine clandestina*	twining glycine		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
Fabaceae (Faboideae)	*Jacksonia scoparia*	dogwood		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
Fabaceae (Faboideae)	*Podolobium scandens*	netted shaggy pea		x
Fabaceaw (Faboideae)	*Pultenaea palacea*			x
Fabaceae (Faboideae)	*Pultenaea villosa*	grey bush-pea		x
Fabaceae (Faboideae)	**Trifolium arvense*	haresfoot clover		x
Fabaceae (Faboideae)	**Trifolium repens*	white clover	x	x
Fabaceae (Mimosoideae)	*Acacia binervata*	two-veined hickory		x
Fabaceae (Mimosoideae)	*Acacia deanei* subsp. *deanei*	Deanes wattle		x
Fabaceae (Mimosoideae)	*Acacia decurrens*	black wattle		x
Fabaceae (Mimosoideae)	*Acacia falcata*	sickle wattle		x
Fabaceae (Mimosoideae)	*Acacia floribunda*	white Sally		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Fabaceae (Mimosoideae)	*Acacia implexa*	hickory wattle		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
Fabaceae (Mimosoideae)	*Acacia parvipinnula*	silver-stemmed wattle		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
Haloragaceae	*Gonocarpus tetragynus*	a raspwort		x
Lamiaceae	*Plectranthus parviflorus*	native cockspur	x	x
Lauraceae	*Cassytha glabella*	devils twine		x
Lauraceae	*Cassytha pubescens*	devils twine		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	x
Malvaceae	**Sida rhombifolia*	Paddys lucerne	x	x
Myoporaceae	*Eremophila debilis*	winter apple		x
Myrsinaceae	*Myrsine howittiana*	brush muttonwood		x
Myrtaceae	*Angophora bakeri*	narrow-leaved apple		x
Myrtaceae	*Angophora floribunda*	rough-barked apple	x	x
Myrtaceae	*Backhousia myrtifolia*	grey myrtle		x
Myrtaceae	*Callistemon linearis*	narrow-leaved bottlebrush		x
Myrtaceae	*Corymbia eximia*	yellow bloodwood		x
Myrtaceae	*Corymbia maculata*	spotted gum		x
Myrtaceae	*Eucalyptus acmenoides*	white mahogany		x
Myrtaceae	*Eucalyptus amplifolia* subsp. *amplifolia*	cabbage gum	x	x
Myrtaceae	*Eucalyptus amplifolia* X *tereticornis*			x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Myrtaceae	*Eucalyptus canaliculata*	large-fruited grey gum	x	x
Myrtaceae	*Eucalyptus crebra*	narrow-leaved ironbark		x
Myrtaceae	*Eucalyptus eugenioides*	thin-leaved stringybark		x
Myrtaceae	*Eucalyptus fergusonii* subsp. *fergusonii*	an ironbark		x
Myrtaceae	*Eucalyptus fibrosa*	red ironbark	x	x
Myrtaceae	*Eucalyptus globoidea*	white stringybark		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
Myrtaceae	*Eucalyptus punctata* X *canaliculata*			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
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* subsp. *cismontanum*	lemon-scented tea tree		x
Myrtaceae	*Leptospermum trinervium*	paperbark tea tree		x
Myrtaceae	*Melaleuca decora*	ball honeymyrtle	x	x
Myrtaceae	*Melaleuca linariifolia*	snow in summer	x	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
Oxalidaceae	*Oxalis chnoodes*	a wood sorrel		x
Oxalidaceae	*Oxalis exilis*	a wood sorrel	x	x
Oxalidaceae	*Oxalis perennans*	grassland wood sorrel	x	x
Phytolaccaceae	**Phytolacca octandra*	inkweed		x
Pittosporaceae	*Billardiera scandens* var. *scandens*	apple berry		x
Pittosporaceae	*Bursaria spinosa* var. *spinosa*	blackthorn	x	x
Plantaginaceae	*Plantago debilis*	common plantain		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
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	x
Primulaceae	**Anagallis arvensis*	scarlet/blue pimpernel	x	x
Proteaceae	*Banksia spinulosa* var. *collina*	hairpin banksia		x
Proteaceae	*Grevillea montana*	a grevillea		x
Proteaceae	***Grevillea parviflora* subsp. *parviflora***	**white spider flower**		**x**
Proteaceae	*Grevillea sericea subsp.* sericea	pink spider flower		x
Proteaceae	*Hakea dactyloides*	finger hakea, broad-leaved hakea		x
Proteaceae	*Hakea sericea*	needlebush		x
Proteaceae	*Persoonia linearis*	narrow-leaved geebung		x
Ranunculaceae	*Clematis glycinoides*	headache vine		x
Ranunculaceae	*Ranunculus inundatus*	river buttercup		x
Rosaceae	**Rosa rubiginosa*	sweet briar	x	x
Rosaceae	**Rubus fruticosus* sp. agg.	blackberry complex	x	x
Rosaceae	*Rubus parvifolius*	native raspberry		x
Rubiaceae	*Asperula conferta*	common woodruff	x	x
Rubiaceae	*Galium propinquum*	Maori bedstraw		x
Rubiaceae	*Opercularia aspera*	coarse stinkweed		x
Rubiaceae	*Pomax umbellata*	pomax		x
Rubiaceae	**Richardia stellaris*	field madder		x
Rutaceae	*Boronia parviflora*	swamp boronia		x
Rutaceae	*Boronia polygalifolia*	dwarf boronia		x
Rutaceae	*Melicope micrococca*	hairy-leaved doughwood		x
Rutaceae	*Phebalium squamulosum* subsp. *squamulosum*	scaly phebalium		x
Santalaceae	*Exocarpos cupressiformis*	native cherry		x
Santalaceae	*Exocarpos strictus*	dwarf cherry		x
Santalaceae	*Leptomeria acida*	native currant		
Sapindaceae	*Dodonaea triquetra*	large-leaf hop-bush		x
Solanaceae	*Solanum brownii*	violet nightshade		x
Solanaceae	*Solanum cinereum*	Narrawa burr		x
Solanaceae	**Solanum mauritianum*	wild tobacco bush	x	x
Solanaceae	**Solanum nigrum*	black-berry nightshade	x	x
Solanaceae	*Solanum prinophyllum*	forest nightshade		x
Solanaceae	*Solanum pungetium*	eastern nightshade		x
Stackhousiaceae	*Stackhousia muricata*	western stackhousia		x
Stackhousiaceae	*Stackhousia viminea*	slender stackhousia		x

Family/Sub Family	Scientific Name	Common Name	Stage 3 Modification Area – Survey September 2010	Original Stage 3 Mine Area (Umwelt 2008b)
Sterculiaceae	*Brachychiton populneus* subsp*. populneus*	kurrajong		x
Thymelaeaceae	*Pimelea linifolia* subsp*. linifolia*	slender rice flower		x
Verbenaceae	*Clerodendrum tomentosum*	hairy clerodendrum,		x
Verbenaceae	**Lantana camara*	lantana		x
Verbenaceae	**Verbena bonariensis*	purpletop	x	x
Violaceae	*Viola hederacea*	ivy-leaved violet	x	x
Vitaceae	*Cayratia clematidea*	slender grape		x
Vitaceae	*Cissus antarctica*	water vine		x

APPENDIX B

Threatened Species Tables

Appendix B – Threatened Species Tables

Threatened species, endangered populations, and threatened ecological communities (TECs) recorded during surveys of the Stage 3 Modification Area, and records from the ecological database searches, are listed in **Tables 1** and **2**. To assist in the impact assessment process, the tables also contain relevant ecological details of each listing, including their habitat requirements, known range and reservation within conservation reserves. 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 Stage 3 Modification Area.

Assessments under Part 3A of the EP&A Act do not currently have formal impact assessment guidelines, however for the purposes of this assessment, the 7 part test required for Part 5A applications has been used for the ecological impact assessment. The tables presented below are intended to streamline the impact assessment process, ensuring that only those species with reasonable potential to occur in the Stage 3 Modification Area and with reasonable potential to be impacted by the Proposed Development are assessed under a 7 part test.

The 7 part tests of significance for species listed under the TSC Act are provided in **Appendix C** (EP&A Act). Species listed under the EPBC Act with reasonable potential to be impacted by the Proposed Development are further assessed in **Appendix D** following the guidelines of that Act.

Table 1 - Threatened Flora Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
THREATENED FLORA SPECIES						
Bynoes wattle *Acacia bynoeana*	E (TSC) V (EPBC) 3VC- (ROTAP)	Occurs in heath or dry sclerophyll forest on sandy soils. Often prefers open, sometimes slightly disturbed sites such as track margins, edges of roadside spoil mounds and in recently burnt areas.	Occurs in central eastern NSW, from Morisset to the Illawarra region and west to the Blue Mountains. It has recently been found in the Colymea and Parma Creek areas west of Nowra, and in the Kurri Kurri, Cessnock and Ellalong areas in the lower Hunter Valley.	Olney SF Yengo NP	There is a low potential for this species to occur within the Spotted Gum – Ironbark Forest of the Stage 3 Modification Area. The Proposed Development will not modify any habitat requirements of this species, and 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Charmhaven apple *Angophora inopina*	V (EPBC) V (TSC) 2R-(ROTAP)	This species typically occurs on the shallow sandy soils of the Narrabeen Group, on exposed ridges and slopes with 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. This species is known to naturally hybridise with rough-barked apple (*A. floribunda*) particularly around major drainage lines.	Distribution confined to the Wyong, Lake Macquarie and Port Stephens LGA of NSW. 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.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
nettled bottle brush *Callistemon linearifolius*	V (TSC) 2RCi (ROTAP)	Typically grows in dry sclerophyll forest on the coast and adjacent ranges	The distribution of this species is primarily known from the areas of the Georges River and the Hawkesbury River near Sydney, reaching to Nelsons Bay in the north (although species have been recorded in the past from as far north as Woolgoolga), and to the west at Cessnock in the Hunter Valley.	Heaton SF Werakata NP	This species has potential to occur within the Stage 3 Modification Area in a variety of habitats. The Proposed Development will not modify any habitat requirements of this species; 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
leafless tongue orchid *Cryptostylis hunteriana*	V (TSC) V (EPBC) 3VC-(ROTAP)	This species appears to favour moist soils on the flat coastal plains. Occupies swamp heath, but also in sclerophyll forest and woodland, often on sandy soils. Typically found in communities containing hard-leaved scribbly gum (*Eucalyptus haemastoma*), brown stringybark (*E. capitellata*) and red bloodwood (*Corymbia gummifera*).	This species is known to occur in the Karuah Manning and Wyong CMA sub-regions in the Hunter Central Rivers region.	This species is not known to occur in any reserves in the region.	This species potentially occurs in the Stage 3 Modification Area in various habitats. The Proposed Development will not modify any habitat requirements of this species; there is no potential for a significant impact on potential habitat of this species.	No
small snake orchid *Diuris pedunculata*	E (TSC) E (EPBC) 2E (ROTAP)	The small snake orchid grows on grassy slopes or flats, often on peaty soils in moist areas and also on shale and trap soils, on fine granite, and among boulders.	Originally found scattered from Tenterfield south to the Hawkesbury River, but is now mainly found on the New England Tablelands, around Armidale, Uralla, Guyra and Ebor, with scattered recent records from west of Manobalai NR and near Uffington SF.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur in the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
slaty red gum *Eucalyptus glaucina*	V (TSC) V (EPBC) 3VCa (ROTAP)	This species grows in grassy woodland and dry eucalypt forest on deep, moderately fertile and well-watered soils.	Found only on the North Coast of NSW and in separate districts: near Casino (where it can be locally common) and further south, from Taree to Broke, west of Maitland. Scattered occurrences around Singleton.	Pokolbin SF Uffington SF Werakata NP	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
Parramatta red gum *Eucalyptus parramattensis* subsp. *decadens*	V (EPBC) V (TSC) 2V (ROTAP)	Typically grows on deep, low-nutrient sands, often those subject to periodic inundation. Occurs in dry sclerophyll woodland with dry heath understorey and also as an emergent in dry or wet heathland.	There are two separate meta-populations, in the Kurri Kurri and Tomago areas.	Heaton SF Werakata NP Werakata SCA	There is no potential for this species to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
small-flower grevillea *Grevillea parviflora* subsp. *parviflora*	V (EPBC) V (TSC)	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest and a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	Sporadically distributed throughout the Sydney Basin mainly occurring around Picton, Appin, Bargo and possibly Moss Vale, as well as in the north from Putty to Wyong, Lake Macquarie, Cessnock and Kurri Kurri in the lower Hunter.	Werakata NP Werakata SCA	This species was recorded in the Spotted Gum – Ironbark Forest in the Stage 3 Modification Area.	**Yes**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
biconvex paperbark *Melaleuca biconvexa*	V (TSC)	Biconvex paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Scattered and dispersed populations of this species are known to occur in the Karuah Manning and Wyong sub-regions of the Hunter-Central Rivers CMA area.	Olney SF Sugarloaf SCA	There is no potential for this species to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
Groves paperbark *Melaleuca groveana*	V (TSC) 3RC-(ROTAP)	Groves paperbark grows in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs. It also occurs in dry woodlands.	Widespread, scattered populations in coastal districts north of Port Stephens to south-east Queensland.	Corrabare SF Yengo NP Werakata SCA	There is no potential for this species to occur within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
North Rothbury persoonia *Persoonia pauciflora*	E (TSC) CE (EPBC) 2E (ROTAP)	It is found in dry open forest or woodland dominated by spotted gum (*Corymbia maculata*), broad-leaved ironbark (*Eucalyptus fibrosa*) and/or narrow-leaved ironbark (*E. crebra*) and supporting a moderate to sparse shrub layer and grassy groundcover. The majority of the population is known to occur on silty sandstone soils derived from the Farley Formation.	Extremely restricted distribution; all but one of the plants which make up the only known population occur within a 2.5 km radius of the original specimen at North Rothbury in the Cessnock LGA. Within this range, there are three main sub-populations which comprise approximately 90% of the total population. The other 10% of the population occurs as scattered individuals in what is a relatively disturbed landscape.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
leek orchid *Prasophyllum* sp. Wybong (C.Phelps ORG 5269)	CE (EPBC)	This species generally occurs in grassy and scrubby habitats in open eucalypt woodland and grasslands.	This species is endemic to NSW, from which there are only seven known populations from near NSW near Ilford, Premer, Muswellbrook, Wybong, Yeoval, Inverell and Tenterfield. It is not known to occur outside the Sydney Basin, New England Tablelands, Brigalow Belt South and NSW South Western Slopes bioregions. It's area of occupancy is estimated at 1.5 km²	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 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Singleton mint bush *Prostanthera cineolifera*	V (TSC) V (EPBC) 2K (ROTAP)	Grows in open woodlands on exposed sandstone ridges. Usually found in association with shallow or skeletal sands.	Restricted to only a few localities near Walcha, Scone and St Albans. The species was once known in Yengo NP, however, no records have been made here in many years.	Yengo NP	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
Illawarra greenhood *Pterostylis gibbosa*	E (TSC) E (EPBC) 2E (ROTAP)	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	This species is not known to occur in any reserves in the region.	This species potentially occurs in the Stage 3 Modification Area in various habitats. The Proposed Development will not modify any habitat requirements of this species; there is no potential for a significant impact on potential habitat of this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Eastern underground orchid *Rhizanthella slateri*	V (TSC) E (EPBC) K (ROTAP)	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed.	Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
heath wrinklewort *Rutidosis heterogama*	V (TSC) V (EPBC) 2VCa (ROTAP)	Occurs mostly in heath, often along disturbed roadsides, and also in open forest, primarily in coastal districts.	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.	Werakata NP Werakata SCA	This species was recorded within the Stage 3 Modification Area in the Spotted Gum – Ironbark Forest.	**Yes**
black-eyed Susan *Tetratheca juncea*	V (TSC) V (EPBC) 3VCa (ROTAP)	Low open forest, woodland, heathland and moist forest, with a shrub understorey and grassy groundcover on low nutrient soils. Generally prefers well-drained slopes (often south-facing) and ridges, although it also found on upper and mid-slopes and occasionally in gullies.	Confined to coastal districts from Bulahdelah to Lake Macquarie. Furthest inland occurrences are at Buttai, near Mt Sugarloaf.	Heaton SF Sugarloaf SCA	This species was not recorded in the Stage 3 Modification Area and there is no potential for it to occur. 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 (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
ENDANGERED FLORA POPUALTIONS						
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.	This population is not known to occur in any reserves in the region.	No individuals of *Acacia pendula* were recorded within the Stage 3 Modification Area, and there is no potential for this species to occur. There is no potential for a significant 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.	This population is not known to occur in any reserves in the region.	No individuals of *Cymbidium canaliculatum* were recorded within the Stage 3 Modification Area, and there is no potential for this species to occur. There is no potential for a significant impact on this endangered population.	No.

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
river red gum *Eucalyptus camaldulensis* in the Hunter Catchment	EP (TSC)	River red gums are located on the banks and floodplains of watercourses on alluvial soils. This endangered population may occur with forest red gum (*Eucalyptus tereticornis*), yellow box (*Eucalyptus melliodora*), river oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*) and rough-barked apple (*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.	This population is not known to occur in any reserves in the region.	No individuals of *Eucalyptus camaldulensis* were recorded within the Stage 3 Modification Area, and there is no potential for this species to occur. There is no potential for a significant 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.	The Hunter Catchment population of *L. lamprophyllum* subsp. *obovatum* is currently known to occur in Pokolbin State Forest. The total number of mature individuals is estimated to be very low with only 4 individuals currently known.	This population is not known to occur in any reserves in the region.	No individuals of *Leionema lamprophyllum* subsp. *obovatum* were recorded within the Stage 3 Modification Area, and there is no potential for this species to occur. There is no potential for a significant impact on this endangered population.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
THREATENED ECOLOGICAL COMMUNITIES						
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with coastal areas subject to periodic flooding and in which standing fresh water persists for at least part of the year in most years. Typically occurs on silts, mud or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, back-swamps, lagoons and lakes but may also occur in back-barrier landforms where floodplains adjoin coastal sand plains. Generally occur below 20 m elevation on level areas.	Known from along the majority of the NSW coast. There is less than 150 ha remaining on the Tweed lowlands (estimate in 1985); about 10,600 ha on the lower Clarence floodplain (in 1982); about 11,200 ha on the lower Macleay floodplain (in 1983); about 3500 ha in the lower Hunter – Central Hunter region (in 1990s); less than 2700 ha on the NSW south coast from Sydney to Moruya (in the mid 1990s), including about 660 ha on the Cumberland Plain (in 1998) and about 100 ha on the Illawarra Plain (in 2001); and less than 1000 ha in the Eden region (in 1990).	This community is poorly reserved but is known from Hunter Estuary NP	This EEC has no potential to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions	EEC (TSC)	This community generally occurs on floodplains and their associated floodplain rises in along the Hunter River and its tributaries. The community is generally tall woodland, with typical canopy species consisting of rough-barked apple (*Angophora floribunda*), river red gum (*Eucalyptus camaldulensis*), forest red gum (*Eucalyptus tereticornis*) and yellow box (*Eucalyptus melliodora*). Other common species are inclusive of kurrajong (*Brachychiton populneus* subsp. *populneus*) and river oak (*Casuarina cunninghamiana* subsp. *cunninghamiana*)	This community can be found along the Hunter River and its associated tributaries and is only known to occur in the NSW North Coast and Sydney Basin Bioregions. It has been recorded from the LGAs of Maitland, Mid-Western, Muswellbrook, Singleton and Upper Hunter.	This EEC is not known from any conservation reserves in the region.	This EEC does not occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No
Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregion	EEC (TSC)	This EEC occurs on the Permian sediments of the Hunter Valley floor. Much of the remaining community is disturbed and fragmented. The floristic composition and structure of the community is influenced by both the size and disturbance history of the remaining fragments. Consequently at heavily disturbed sites only some of the species which characterise the community may be present.	This EEC occurs from Muswellbrook to the Lower Hunter in the Sydney Basin and North Coast bioregions. It has been recorded from the Maitland, Cessnock, Port Stephens, Muswellbrook and Singleton LGAs, but may occur elsewhere in these bioregions.	Werakata NP Werakata SCA.	This EEC does not occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Lower Hunter Spotted Gum – Ironbark Forest in the Sydney Basin Bioregion	EEC (TSC)	This EEC occurs in the central to lower Hunter Valley, principally on Permian geology.	The EEC is restricted to a range of approximately 65 km by 35 km centred on the Cessnock – Beresfield area.	Corrabare SF Pokolbin SF Werakata NP	This EEC occurs widely within the Stage 3 Modification Area, on the drier slopes and ridges.	**Yes**
Quorrobolong Scribbly Gum Woodland in the Sydney Basin Bioregion	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 LGA but may occur elsewhere.	This EEC is not known from any conservation reserves in the region.	A small remnant of this EEC occurs just outside the Stage 3 Modification Area, however there are no areas of this EEC that will be disturbed as a result of the Proposed Development. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Given its habitat, the community has an important role in maintaining river ecosystems and riverbank stability. Occurs on with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level. The composition of this EEC is highly variable, although typical species include forest red gum (*Eucalyptus tereticornis*), cabbage gum (*E. amplifolia*), rough-barked apple (*Angophora floribunda*) and broad-leaved apple (*A. subvelutina*).	This EEC occurs in numerous LGAs on the south coast of NSW. It is believed to be bounded to the north by Port Stephens, to the south by the NSW-VIC border and to occur no further west than Canberra.	This EEC is not known from any conservation reserves in the region.	Approximately 48.7 ha of River-flat Eucalypt Forest is present within the Stage 3 Modification Area. This riparian community has potential to be impacted by the Proposed Development.	**Yes**
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	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. Generally occurs below 20 m (rarely above 10 m) elevation	This community is known from parts of the LGAs of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions.	Hunter Estuary NP	This EEC does not occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC (TSC)	Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Generally occurs below 20 m (though sometimes up to 50 m) elevation. The composition of the community is primarily determined by the frequency and duration of water logging and the texture, salinity nutrient and moisture content of the soil, and latitude. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs.	This community is known to occur in numerous LGAs, but is believed to be restricted to the areas of coastal NSW; no further south than the Shoalhaven LGA and as far north as the NSW-Queensland border, but no further west than Bathurst.	Ellalong Lagoon LCA Hunter Estuary NP	This EEC has no potential to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area/Potential to be Impacted	Detailed Assessment of Significance Required?
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands	CEEC (EPBC)	This EEC can occur as either woodland or derived grassland (grassy woodland from which trees have been removed). Groundlayer consists of native tussock grasses and herbs, and a sparse, scattered shrub layer. White box (*Eucalyptus albens*), yellow box (*E. melliodora*), or Blakelys red gum (*E. blakelyi*), dominate, where trees remain. Sites dominated by other tree species that do not have white box, yellow box, or Blakelys red gum as co-dominants are not considered to be part of the community, except in the Nandewar bioregion. In the Nandewar Bioregion, grey box (*E. moluccana* or *E. microcarpa*) may also be dominant or co-dominant in the community.	This EEC is found from the Queensland border in the north, to the Victorian border in the south. It occurs in the tablelands and western slopes of NSW.	This EEC is not known from any conservation reserves in the region.	This EEC has no potential to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this EEC.	No

Note:

2:	found over < 100 km
3:	found over > 100 km
a:	adequately reserved
C:	in a conservation reserve
E:	endangered
EEC:	endangered ecological community
EP:	endangered population
EPBC:	Environment Protection Biodiversity Conservation Act
FM:	Fisheries Management Act
i:	inadequately reserved
K:	poorly known
LCA:	Landscape Conservation Area
LGA:	Local Government Area
MAR:	marine
MIG:	migratory
NR:	Nature Reserve
NP:	National Park
PD:	preliminary determination
R:	rare
TSC:	Threatened Species Conservation Act
V:	Vulnerable
-	species recorded from a reserve but population size unknown

Table 2 - Threatened Fauna Assessment

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
AMPHIBIANS						
giant burrowing frog *Heleioporus australiacus*	V (TSC) V (EPBC)	Found in heath, woodland and open forest with sandy soils.	Occurs from the NSW Central Coast to eastern Victoria, but is most common on the Sydney sandstone. It has been found from the coast to the Great Dividing Range.	Yengo NP	There is no potential for this species to occur due to the absence of suitable sandstone habitats. There is no potential for a significant impact on this species.	No
stuttering frog *Mixophyes balbus*	E (TSC) V (TSC)	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	Occur along the east coast of Australia from southern Queensland to the north-eastern Victoria	Killarney NR Watagans NP	There is no potential for this species to occur due to absence of rainforest or tall open forest habitat. There is no potential for a significant impact on this species.	No
giant barred frog *Mixophyes iteratuts*	E (TSC)	This species forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams.	Coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area, is now a stronghold.	Watagans NP	There is no potential habitat for this species due to absence of suitable rainforest habitats. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
green and golden bell frog *Litoria aurea*	E (TSC) V (EPBC)	Occurs amongst emergent aquatic or riparian vegetation and amongst vegetation, fallen timber, including grassland, cropland and modified pastures. Breeds in still or slow flowing waterbodies with some vegetation such as *Typha* spp. and *Eleocharis* spp.	NSW North Coast near Brunswick Heads, southwards along the NSW Coast to Victoria where it extends into east Gippsland. The Survey Area is close to the inland limit of this species' known distribution.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur in the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
green-thighed frog *Litoria brevipalmata*	V (TSC)	Occur 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.	Isolated localities along the coast and ranges from the NSW central coast to south-east Queensland.	This species is not known to occur in any reserves in the region.	There is a low potential for this species to occur in the riparian habitats of the Stage 3 Modification Area. Given this species occupies riparian habitats, there is some potential for an impact on potential habitat for this species as a result of the Proposed Development.	**Yes**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
Littlejohns treefrog *Litoria littlejohni*	V (TSC) V (EPBC)	Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria.	Olney SF	There is no potential for this species to occur within the Stage 3 Modification Area due to the absence of permanent rocky streams. There is no potential for a significant impact on this species.	No
REPTILES						
broad-headed snake *Hoplocephalus bungaroides*	E (TSC) V (EPBC)	This species is nocturnal and shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	The broad-headed snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney.	Olney SF Yengo NP	Due to the absence of sandstone outcrops, there is no potential for this species to occur within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
BIRDS						
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.	Hunter Estuary NP	There are no freshwater wetland habitats present within the Stage 3 Modification Area that would provide suitable habitat for this species. There is no potential for a significant impact on this species.	No
Australian painted snipe *Rostratula australis*	E (TSC) V (EPBC) MAR (EPBC) MIG (EPBC)	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowal, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin.	Pambalong NR	There are no habitats present within the Stage 3 Modification Area that would be suitable for this species. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
freckled duck *Stictonetta naevosa*	V (TSC)	This species prefers permanent freshwater swamps and creeks with heavy growth of cumbungi, lignum or tea-tree. During drier times it moves from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. This species generally rests in dense cover during the day, usually in deep water. Nesting usually occurs between October and December but can take place at other times when conditions are favourable. The nests are usually located in dense vegetation at or near water level.	The freckled duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. This species may also occur as far as coastal NSW and Victoria during such times.	This species is not known to occur in any reserves in the region.	There is no potential for this species to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
black-breasted buzzard *Hamirostra melanosternon*	V (TSC)	Lives in a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Hunts over grasslands and sparsely timbered woodlands.	Found sparsely in areas of less than 500 mm rainfall, from north-western NSW and north-eastern South Australia to the east coast at about Rockhampton, then across northern Australia south almost to Perth, avoiding only the Western Australian deserts.	Werakata NP	There is no potential for this species to occur in the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
little eagle *Heiraaetus morphnoides*	V (TSC)	This species is typically identified in open eucalypt forests, woodlands and open woodlands, and other areas where prey are plentiful. The nest in tall living trees within remnant patches.	The little eagle is distributed throughout mainland Australia except for the most densely forested parts of the Great Dividing Range escarpment.	Olney SF Werakata SCA	There is potential foraging and nesting habitat for this species in various habitats throughout the Stage 3 Modification Area. There will be no modification to the potential habitats of this species as a result of the Proposed Development. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
square-tailed kite *Lophoictinia isura*	V (TSC)	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems.	This species is not known to occur in any reserves in the region.	The Stage 3 Modification Area supports potential foraging and nesting habitat for this species. The Proposed Development 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)	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies.	Occurs throughout coastal Australia and well inland in the north from the Kimberley to Sydney. Vagrants occasionally appear further south, possibly in response to unfavourable conditions further north in NSW.	This species is not known to occur in any reserves in the region.	There are no dam habitats suitable for this species within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
red goshawk *Erythrotriorchis radiatus*	CE (TSC) V (EPBC)	In NSW, the red goshawk is mainly found along or near watercourses, in swamp forest and woodlands on the coastal plain. It favours patches of dense forest interspersed with open woodland or cleared land and often frequents forest edges.	Across northern Australian south through eastern Queensland to far north-east NSW. The species is very rare in NSW. Most records are from the Clarence River Catchment, with a few about the lower Richmond and Tweed Rivers.	This species is not known to occur in any reserves in the region.	The Stage 3 Modification Area supports potential habitat for this species. The Proposed Development 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 lorikeet *Glossopsitta pusilla*	V (TSC)	This species can be found in dry-open eucalypt forests and woodlands, and have been identified in remnant vegetation, old growth vegetation, logged forests, and roadside vegetation. The little lorikeet usually forages in small flocks, not always with birds of their own species. They nest in hollows, mostly in living smooth-barked apples.	This species is distributed from just north of Cairns, around the east coast of Australia down to Adelaide. In NSW this species is found from the coast to the western slopes of the Great Dividing Range, extending as far west as Albury, Dubbo, Parkes and Narrabri.	Olney SF Pokolbin SF Sugarloaf SCA Werakata NP Werakata SCA Yengo NP	The Stage 3 Modification Area provides potential foraging and nesting habitats for this species. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)	Habitat for this species includes forests on low-nutrient soils, specifically those containing key *Allocasuarina* feed species. They will also eat seeds from eucalypts, angophoras, acacias, cypress pine and hakeas, as well as eating insect larvae. Breeding occurs in autumn and winter, with large hollows required.	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.	Killarney NR Watagans NP Werakata NP Yengo NP	The Stage 3 Modification Area provides potential foraging habitat, however limited nest sites. The Proposed Development 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
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC)	In summer this species occurs in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter this species moves to drier more open eucalypt forests and woodlands. It favours old growth trees for nesting and roosting.	In NSW this species occurs from the south east coast to the Hunter region and inland to the Central Tablelands and South-west Slopes.	Pambalong NR Watagans NP Werakata NP Yengo NP	This species was recorded within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
swift parrot *Lathamus discolor*	E (TSC) E (EPBC) MAR (EPBC)	This species often visits box-ironbark forests, feeding on nectar and lerps. In NSW, typical tree species in which it forages include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box. This bird is a migratory species that breeds in Tasmania during the spring and summer, and migrates to the mainland during the cooler months of the year.	In NSW this species 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. The project area is within the known distribution of this species.	Werakata NP	Several winter-flowering species occur in the Stage 3 Modification Area which may provide foraging resources for this species.	**Yes**
regent honeyeater *Anthochaera phrygia*	CE (TSC) E (EPBC) MIG (EPBC)	This species generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. An apparent preference exists for the wettest, most fertile sites within these associations, such as creek flats, river valleys and foothills.	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.	Corrabare SF Werakata NP Werakata SCA Yengo NP	Several winter-flowering species occur in the Stage 3 Modification Area which may provide foraging resources for this species.	**Yes**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
turquoise parrot *Neophema pulchella*	V (TSC)	This species lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. It nests in tree hollows, logs or posts, from August to December.	The turquoise parrots range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.	This species is not known to occur in any reserves in the region.	This species potentially forages within the Stage 3 Modification Area, and there are potential nesting habitats. The Proposed Development 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
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. It generally 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.	The powerful owl occurs in eastern Australia, mostly on the coastal side of the Great Dividing Range, from south western Victoria to Bowen in Queensland.	Killarney NP Monkerai NP Werakata NP Yengo NP	This species was recorded in the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
barking owl *Ninox connivens*	V (TSC)	Habitat for this species includes dry forests and woodlands, often in association with hydrological features such as rivers and swamps.	The barking owl is distributed sparsely throughout temperate and semi-arid areas of mainland Australia, however it is most abundant in the tropical north. Most records for this species occur west of the Great Dividing Range.	Watagans NP Werakata NP	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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)	This species is 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.	The masked owl occurs sparsely throughout the continent and nearby islands, including Tasmania and New Guinea.	Killarney NR Pokolbin SF Watagans NP Werakata SCA	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance 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 eastern most one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands.	Corrabare SF Heaton SF Olney SF Pokolbin SF Watagans NP	There is no potential habitat for this species to occur within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
brown treecreeper (eastern subsp.) *Climacteris picumnus victoriae*	V (TSC)	Typical habitat for this species includes drier forests, woodlands and scrubs with fallen branches; river red gums on watercourses and around lake-shores; paddocks with standing dead timber; and margins of denser wooded areas. This species prefers areas without a dense understorey.	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.	Werakata NP	Potential habitat for this species occurs within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
black-chinned honeyeater (eastern subspecies) *Melithreptus gularis*	V (TSC)	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially mugga ironbark, white box, grey box, yellow box and forest red gum. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	The subspecies is widespread, from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions.	Werakata NP	There is potential for this species to occur within the Stage 3 Modification Area. The Proposed Development 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 *Chthonicola sagittata*	V (TSC)	The speckled warbler occurs in eucalypt-dominated communities that have a grassy understorey, leaf litter and shrub cover, often on rocky ridges or in gullies.	Patchy distribution throughout south-eastern Queensland, eastern half of NSW and into Victoria, as far west as the Grampians.	Werakata NP Yengo NP	This species was recorded during surveys of the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
grey-crowned babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V(TSC)	Open box-gum woodlands on the slopes. Box-cypress-pine and open box woodlands on alluvial plains. Also found in acacia shrubland and adjoining areas.	Occurs throughout northern and south-eastern Australia. In NSW, this species occurs on the western slopes of the Great Dividing Range and on the western plains reaching as far west as Louth and Hay. It also occurs in woodlands in the Hunter Valley and in several locations on the north coast of NSW. The Survey Area is not at the limit of this species' known distribution.	Werakata NP Yengo NP	This species was recorded during surveys of the Stage 3 Modification Area. The Proposed Development will not modify any habitat requirements of this species. As such there is no potential for a significant impact on this species.	No
varied sittella *Daphoenositta chrysoptera*	V (TSC)	The varied sittella can typically be found in eucalypt forests and woodlands, especially of rough-barked species and mature smooth-barked gums with dead branches, it can also be identified in mallee and acacia woodlands. This species builds a cup shaped nest made of plant fibres and spiders webs which is placed at the canopy level in the fork of a living tree.	The varied sittella is a sedentary species that inhabits the majority of mainland Australia with the exception of the treeless deserts and open grasslands. Its NSW distribution is basically continuous from the coast to the far west.	Corrabare SF Olney SF Pokolbin SF Werakata NP Werakata SCA Yengo NP	There is potential for this species to occur within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
scarlet robin *Petroica boodang*	V (TSC)	This robin can be found in woodlands and open forests from the coast through to inland slopes. The birds can sometimes be found on the eastern fringe of the inland plains in the colder months of the year. Woody debris and logs are both important structural elements of its habitat. It forages from low perches on invertebrates either on the ground or in woody debris or tree trunks.	The scarlet robin can be found in south-eastern Australia, from Tasmania to the southern end of Queensland, to western Victoria and south SA.	Olney SF Werakata NP Yengo NP	This species was recorded in the Stage 3 Modification Area. The Proposed Development 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
diamond firetail *Stagonopleura guttata*	V (TSC)	Habitat includes a range of eucalypt dominated communities with a grassy understorey, including woodland, forest and mallee. It appears that populations are unable to persist in areas where there are no vegetated remnants larger than 200 ha.	The diamond firetail occurs through central and eastern NSW, north into southern and central Queensland and south through Victoria to South Australia. 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.	Werakata SCA Yengo NP	There is potential for this species to occur within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
MAMMALS						
spotted-tailed quoll *Dasyurus maculatus*	V (TSC) E (EPBC)	Habitat for this species is highly varied, ranging from sclerophyll forest, woodlands, coastal heathlands and rainforests. Records exist from open country, grazing lands and rocky outcrops. Suitable den sites including hollow logs, tree hollows, rocky outcrops or caves.	In NSW the spotted-tailed quoll occurs on both sides of the Great Dividing Range, with the highest densities occurring in the north-east of the state. It occurs from the coast to the snowline and inland to the Murray River.	Awaba SF Corrabare SF Heaton SF Killarney NP Olney SF Pokolbin SF Uffington SF Watagans NP Watagan SF Werakata SCA Yengo NP	There is potential for this species to occur in the more densely vegetated habitats in the north of the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
Koala *Phascolarctos cinereus*	V (TSC)	This species inhabits eucalypt forest and woodland, with suitability influenced by tree species and age, soil fertility, climate, rainfall and fragmentation patterns. The species is known to feed on a large number of eucalypt and non-eucalypt species; however it tends to specialise on a small number in different areas. *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis, E. microcorys, E. robusta, E. albens, E. camaldulensis* and *E. populnea* are some preferred species.	The koala has a fragmented distribution throughout eastern Australia, with the majority of records from NSW occurring on the central and north coasts, as well as some areas further west. It is known to occur along inland rivers on the western side of the Great Dividing Range.	Awaba SF Corrabare SF Heaton SF Killarney NR Monkerai NR Olney SF Pokolbin SF Uffington SF Watagans NP Watagan SF Werakata NP Werakata SCA Yengo NP	Known koala food trees occur within the Stage 3 Modification Area. There is potential for this species to occur. The Proposed Development 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)	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south.	The yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	Corrabare SF Heaton SF Olney SF Pokolbin SF Watagans NP Watagan SF Werakata NP Yengo NP	There is no potential for this species to occur within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
squirrel glider *Petaurus norfolcensis*	V (TSC)	Inhabits a variety of mature or old growth habitats, including box, box-ironbark woodlands, river red gum forest, and blackbutt-bloodwood forest with heath understorey. It prefers mixed species stands with a shrub or acacia mid-storey, and requires abundant tree hollows for refuge and nest sites.	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.	Olney SF Uffington SF Werakata NP Werakata SCA Yengo NP	This species was recorded in the Stage 3 Modification Area. The Proposed Development 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)	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	This species is found on the south-eastern coast of Australia, from Queensland to eastern Victoria and Tasmania, including some of the Bass Strait islands. In NSW it is generally restricted to coastal heaths and forests east of the Great Dividing Range.	Heaton SF Killarney NR	The Stage 3 Modification Area does not support suitable habitat for this species. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
brush-tailed rock-wallaby *Petrogale penicillata*	E (TSC) V (EPBC)	This species occupies rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. It browses on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. This species shelters or bask during the day in rock crevices, caves and overhangs and is most active at night.	The brush-tailed rock-wallaby was once abundant and ubiquitous throughout the mountainous country of south-eastern Australia. Its distribution roughly followed the Great Dividing Range for 2500 km from the Grampians in West Victoria to Nanango in south-east Queensland, with outlying populations in coastal valleys and ranges to the east of the divide, and the slopes and plains as far west as Cobar in NSW and Injune (500 km NW of Brisbane) in Queensland.	Watagans NP Heaton SF Olney SF Pokolbin SF Watagans NP Yengo NP	The Stage 3 Modification Area does not support suitable habitat for this species. There is no potential for a significant impact on this species.	No
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC)	This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy.	Grey-headed flying-foxes are found within 200 km of the eastern coast of Australia, from Bundaberg in Queensland to Melbourne in Victoria.	Olney SF Pokolbin SF Watagan SF Werakata NP Werakata SCA Yengo NP	The Stage 3 Modification Area supports potential foraging habitat for this species, however, there are no known roost sites.	**Yes**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC)	This species occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. It roosts mainly in tree hollows but will also roost under bark or in man-made structures.	The eastern freetail-bat is found along the east coast from south Queensland to southern NSW.	Awaba SF Werakata NP Werakata SCA Yengo NP	This species was recorded within the Stage 3 Modification Area. The Proposed Development 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)	This species hunts in forested areas and uses caves as the primary roosting habitat, but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Eastern bent-wing bats occur along the east and north-west coasts of Australia.	Awaba SF Olney SF Uffington SF Werakata NP Yengo NP	This species was recorded within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	Habitat for this species includes sclerophyll forest. It prefers wet habitats, with trees over 20 m high, and generally roosts in tree hollows or trunks.	This species has a range from south eastern Queensland, through NSW, Victoria and into Tasmania, and occurs from the Great Dividing Range to the coast.	Heaton SF Olney SF Werakata NP Yengo NP	This species has potential to utilise the foraging resources of the Stage 3 Modification Area. The Proposed Development 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)	Prefers moist eucalypt forest, rainforest or dense coastal banksia scrub. This species roost in caves, tunnels and sometimes tree hollows during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Occurs in coastal north-eastern NSW and eastern Queensland.	Awaba SF Uffington SF Werakata NP Werakata SCA	This species was recorded within the Stage 3 Modification Area. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
large-eared pied bat *Chalinolobus dwyeri*	V (TSC) V (EPBC)	The large-eared pied bat is generally found in a variety of drier habitats, including dry sclerophyll forests and woodlands, however, it probably tolerates a wide range of habitats. It tends to roost in the twilight zones of mines and caves, generally in colonies or common groups.	This species has a distribution from south western Queensland to NSW from the coast to the western slopes of the Great Dividing Range.	Awaba SF Olney SF Pokolbin SF Watagans NP Yengo NP	This species has potential to utilise the foraging resources of the Stage 3 Modification Area. The Proposed Development 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 adversus*	V (TSC)	This species generally roosts in groups of 10-15 close to water in caves, mine shafts, hollow-bearing trees, and storm-water channels, buildings, under bridges and in dense foliage. It forages over streams and pools catching insects and small fish by raking its feet across the water surface.	The large-footed myotis is found in the coastal band from the north-west of Australia, across the Top-End and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers.	Awaba SF Pokolbin SF Uffington SF Werakata NP	This species was recorded in the Stage 3 Modification Area. As this species largely relies on riparian habitats for foraging, 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance 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.	Awaba SF Olney SF Pokolbin SF Werakata NP Werakata SCA Yengo NP	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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
golden-tipped bat *Kerivoula papuensis*	V (TSC)	Found in rainforest and adjacent sclerophyll forest. Roosts in abandoned hanging yellow-throated scrubwren and brown gerygone nests located in rainforest gullies on small first- and second-order streams. Will fly up to two km from roosts to forage in rainforest and sclerophyll forest on upper-slopes.	The golden-tipped Bat is distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to Bega in southern NSW.	Corrabare SF Heaton SF Olney SF Pokolbin SF Watagan SF	The Stage 3 Modification Area does not support suitable habitat for this species. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
New Holland mouse *Pseudomys novaehollandiae*	V (EPBC)	This species inhabits a range of habitats from open heathlands, open woodlands with a heath understorey, as well as vegetated dunes. The New Holland mouse lives in a burrow which is shared with other individuals.	This species has a disjunct distribution across Tasmania, Victoria, Queensland and NSW	This species is not known to occur in any reserves in the region.	The Stage 3 Modification Area does not support suitable habitat for this species. There is no potential for a significant impact on this species.	No
Hastings River mouse *Pseudomys oralis*	E (TSC) E (EPBC)	Known to inhabit a variety of dry open forest types with dense, low ground cover and a diverse mixture of ferns, grass, sedges and herbs. Access to seepage zones, creeks and gullies is important, as is permanent shelter such as rocky outcrops. Nests may be in either gully areas or ridges and slopes.	This species has a patchy distribution along the east side of the Northern Tablelands and great escarpment of north-east NSW, usually but not always at elevations between 500 m and 1100 m. Also recorded in south-east Queensland.	This species is not known to occur in any reserves in the region.	There is no potential habitat for this species within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
MIGRATORY SPECIES						
regent honeyeater *Anthochaera phrygia*	CE (TSC) E (EPBC) MIG (EPBC)	This species generally occurs in temperate eucalypt woodlands and open forests of south eastern Australia. It is commonly recorded from box-ironbark eucalypt associations, wet lowland coastal forests dominated by swamp mahogany, spotted gum and riverine casuarina woodlands. An apparent preference exists for the wettest, most fertile sites within these associations, such as creek flats, river valleys and foothills.	Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland.	Corrabare SF Werakata NP Werakata SCA Yengo NP	Several winter-flowering species occur in the Stage 3 Modification Area which may provide foraging resources for this species.	**Yes**
fork-tailed swift *Apus pacificus*	MAR (EPBC) MIG (EPBC)	The fork-tailed swift is mostly found in Australia through the months of October through to April. This swift spends most of its time when in flight ahead of storm fonts and updraughts (Slater et al. 2003).	The fork-tailed swift can be found throughout Australia during migrating. In Australia it is most common west of the Great Dividing Range. This species is uncommon in Tasmania.	Pokolbin SF	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
great egret *Ardea modesta*	MAR (EPBC) MIG (EPBC)	The great egret typically inhabits areas of shallow, flowing waters, but also uses damp grasslands and other watered areas. They can be observed both in flocks and on their own, and roost during the night in groups (Australian Museum Online 2005).	The great egret is distributed throughout the world, and is common throughout most areas of Australia, with exception to extremely arid areas.	This species is not known to occur in any reserves in the region.	The Stage 3 Modification Area provides potential habitat for this species. As this species occupies riparian habitats, there is potential for an impact on this species.	**Yes**
cattle egret *Ardea ibis*	MAR (EPBC) MIG (EPBC)	The cattle egret can be found in grasslands, wetlands and woodlands and has never been identified in arid areas. These birds are commonly sighted at garbage dumps, pastures and croplands (especially where poor drainage is present) are common (Australian Museum Online 2005).	The cattle egret is distributed throughout Asia, Africa, Europe and Australia. It is most commonly found in north-eastern WA, the NT and in south-eastern Australia from Bundaberg Queensland through to Port Augusta SA. It has also been identified in Tasmania.	Werakata NP	The Stage 3 Modification Area provides potential habitat for this species. As this species occupies riparian habitats, 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
Japanese snipe *Gallinago hardwickii*	MAR (EPBC) MIG (EPBC)	The Japanese snipe can be found in permanent and ephemeral wetlands up to 2000 m ASL. These water bodies are usually freshwater with low, dense vegetation. They forage in areas of mud with some vegetation cover and roost nearby to these areas. The Japanese snipe does not breed in Australia, only passing through for migration.	This species has been recorded from Cape York through to south-east SA. The range of this species extends from inland of the eastern tablelands in south-east Queensland to west of the Great Dividing Range in NSW. Richmond River, NSW is a favourite area for non-breeding birds.	This species is not known to occur in any reserves in the region.	There is no potential habitat for this species within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No
white-bellied sea-eagle *Haliaeetus leucogaster*	MAR (EPBC) MIG (EPBC)	These birds are typically sighted perched in tall trees and soaring above bodies of water and land. They are territorial and form permanent breeding pairs (Australian Museum Online 2005).	This species is distributed across Australia, China, India, Indonesia, New Guinea, and south-east Asia. Within Australia it is distributed along and near the coast.	Werakata NP	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
white-throated needletail *Hirundapus caudacutus*	MAR (EPBC) MIG (EPBC)	This species is only in Australia approximately between the months of October and May. They forage upon flying insects and drink whilst in flight. Feeding is typically associated with rising thermal currents typical with storm fronts and bushfires. (Australian Museum Online 2003)	This species is distributed over eastern and northern Australia	Heaton SF Pokolbin SF Werakata NP Werakata SCA Yengo NP	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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
swift parrot *Lathamus discolor*	E (TSC) E (EPBC) MAR (EPBC)	This species often visits box-ironbark forests, feeding on nectar and lerps. In NSW, typical tree species in which it forages include mugga ironbark, grey box, swamp mahogany, spotted gum, red bloodwood, narrow-leaved red ironbark, forest red gum and yellow box. This bird is a migratory species that breeds in Tasmania during the spring and summer, and migrates to the mainland during the cooler months of the year.	In NSW this species 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.	Corrabare SF Werakata NP Werakata SCA	Several winter-flowering species occur in the Stage 3 Modification Area which may provide foraging resources for this species.	**Yes**

Species	Legal Status	Specific Habitat	Distribution in relation to Survey Area	Reservation in the Region (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
rainbow bee-eater *Merops ornatus*	MAR (EPBC) MIG (EPBC)	The preferred habitat of the rainbow bee-eater is open forests and woodlands, shrublands, and cleared or semi-cleared areas (commonly farmland). These areas are usually in close proximity to permanent water, however, during migration this bird may fly over areas of non-preferential habitat.	This species is distributed throughout most of mainland Australia as well as several near-shore islands. It is not found in Tasmania and has only been identified in a thin strip in the most arid regions of central WA.	Corrabare SF Pokolbin SF Werakata SCA Werakata SF Yengo NP	This species was recorded in the Stage 3 Modification Area. The Proposed Development 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-faced monarch *Monarcha melanopsis*	MAR (EPBC) MIG (EPBC)	This bird can be identified in coastal scrub, damp gullies, eucalypt woodlands and rainforests. This bird can be seen foraging for insects amongst foliage, and builds a deep, cup-shaped nest in a tree fork (3 to 6 m above the ground) which is made up of cobwebs, casuarinas needles, bark, moss and roots (Australian Museum Online2005).	The black-faced monarch is distributed along the eastern coast of Australia, gradually becoming less common towards the south.	Awaba SF Corrabare SF Heaton SF Pokolbin SF Werakata NP Watagan SF Yengo NP	There is no potential habitat for this species within the Stage 3 Modification Area. 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
satin flycatcher *Myiagra cyanoleuca*	MAR (EPBC) MIG (EPBC)	This species typically inhabits wet areas of tall forests, particularly in gullies. The satin flycatcher moves north in the winter and is seldom seen in NSW, Tasmania, Victoria or SA during these times. This bird nests in loose colonies in broad-based cup-shaped nests on a bare horizontal branch. These nests are constructed from bark, grass, lichen and cobwebs (Australian Museum Online 2005).	The satin flycatcher can be found in both Australia and New Guinea. In Australia it is distributed along the east coast from Cape York through to Tasmania, also covering parts of south-eastern SA.	Pokolbin SF	This species was recorded in the Stage 3 Modification Area. The Proposed Development 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
rufous fantail *Rhipidura rufifrons*	MAR (EPBC) MIG (EPBC)	The rufous fantail typically inhabits areas of dense wet forest, mangrove, rainforest or swamp woodlands. It prefers areas where there is intense shade available and is often seen close to ground. In winter it is seldom found in NSW or Victoria. Nests are about 5 m from the ground in a small cup shape and constructed from thin grasses held together by cobwebs (Australian Museum Online 2005).	This species is distributed across the north and eastern coast of Australia, but is also found in Guam, New Guinea, the Solomon Islands and Sulawesi.	Awaba SF Belford NP Heaton SF Pokolbin SF Uffington SF Watagan SF Werakata NP Werakata SCA Yengo NP	The Stage 3 Modification Area provides potential habitat for this species. The Proposed Development 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 (NSW Government 2009)	Occurrence in Survey Area	Detailed Assessment of Significance Required?
Australian painted snipe *Rostratula australis*	E (TSC) V (EPBC) MAR (EPBC) MIG (EPBC)	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin.	Pambalong NR	There is no potential habitat for this species within the Stage 3 Modification Area. There is no potential for a significant impact on this species.	No

Note

E:	endangered
EPBC:	Environment Protection Biodiversity Conservation Act
FM	Fisheries Management Act
LGA:	Local Government Area
MAR	marine
MIG	migratory
NR:	Nature Reserve
NP:	National Park
TSC:	Threatened Species Conservation Act
V:	vulnerable

APPENDIX C

Assessment of Significance (EP&A Act)

Appendix C – Assessment of Significance (EP&A Act)

Assessments under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) do not currently have formal impact assessment guidelines, however for the purposes of this assessment, the 7 part test required for Part 5A applications, has been used for the ecological impact assessment. The tables presented in **Appendix B** are intended to streamline the impact assessment process, ensuring that only those species with reasonable potential to occur in the Stage 3 Modification Area and with reasonable potential to be impacted by the Proposed Development are assessed under a 7 part test.

A 7 part test of significance was prepared in accordance with the requirements of the (EP&A Act) for each threatened species, population or EEC where there is the potential for an impact as a result of the Proposed Development. As discussed in **Section 7** of the Ecological Assessment, the surface impacts associated with the Proposed Development are predicted to be minimal. While the impacts are expected to be most prominent in the riparian areas, the impacts in those areas will still be minor. Although a number of threatened species were recorded or have potential to occur in the Stage 3 Modification Area, there are few for which there is a possibility of being impacted, given the minor changes that are expected on the surface as a result of the proposed longwall mining.

From **Appendix B**, those listings requiring further assessment are:

- River-flat Eucalypt Forest EEC;
- Lower Hunter Spotted Gum – Ironbark Forest EEC;
- small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*);
- heath wrinklewort (*Rutidosis heterogama*);
- green-thighed frog (*Litoria brevipalmata*);
- swift parrot (*Lathamus discolor*);
- regent honeyeater (*Anthochaera phrygia*);
- grey-headed flying-fox (*Pteropus poliocephalus*); and
- large-footed myotis (*Myotis adversus*).

Below is a 7 part test of significance for each of these, which is prepared in accordance with the requirements of the EP&A Act. Although 7 part tests of significance are not required for developments assessed under Part 3A, 7 part tests are nevertheless used here 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

Some of the riparian vegetation within the Stage 3 Modification Area was found to be consistent with the River-Flat Eucalypt Forest EEC. Subsidence as a result of the Proposed Development is expected to occur relatively uniformly across the Stage 3 Modification area and therefore very little disturbance of surface and groundwater flow patterns is predicted. Based on the subsidence predictions summarised in **Section 7**, it is not likely that the Proposed 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 Development is predicted to have very minor surface impacts, and minor impacts on surface and groundwater flows. Based on the known predictions, it is not likely that the Proposed 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 Development will not lead to the removal or modification of habitat for the River-flat Eucalypt Forest EEC. It is predicted that the Proposed 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 Proposed Development does not involve any clearing of vegetation that would result in the fragmentation or isolation of any areas of the River-flat Eucalypt Forest EEC, within or adjacent to the Stage 3 Modification Area.

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 Modification Area comprises approximately 48.7 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 Modification 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 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 Modification 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 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

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 342.2 hectares of the Lower Hunter Spotted Gum – Ironbark Forest EEC occur in the Stage 3 Modification Area, where it occupies the drier slopes and ridges. In the north of the Stage 3 Modification Area, some parts of this EEC lie within Werakata State Conservation Area. Large areas of this EEC are protected in the SCA and elsewhere in the locality and region.

Subsidence as a result of the Proposed Development is expected to occur relatively uniformly across the Stage 3 Modification area and therefore very little disturbance of surface and groundwater flow patterns is predicted. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. Therefore there is very low potential for this EEC to be impacted. Based on the subsidence predictions summarised in **Section 7**, it is not likely that the Proposed Development will result in the loss or modification of any areas of the Lower Hunter Spotted Gum - Ironbark 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 Development is predicted to have very minor surface impacts, and minor impacts on surface and groundwater flows. Based on the known predictions, it is not likely that the Proposed Development will adversely modify the composition of the Lower Hunter Spotted Gum – Ironbark 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 Development will not lead to the removal or modification of habitat for the Lower Hunter Spotted Gum – Ironbark Forest EEC. It is predicted that the Proposed 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 Proposed Development does not involve any clearing of vegetation that would result in the fragmentation or isolation of any areas of the Lower Hunter Spotted Gum – Ironbark Forest EEC, within or adjacent to the Stage 3 Modification Area.

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 Modification Area comprises approximately 342.2 hectares of the Lower Hunter Spotted Gum – Ironbark Forest EEC which range from low to moderately high condition. High conservation value examples of this community are protected widely within the Werakata State Conservation Area which occurs within and adjacent to the Stage 3 Modification Area.

Given that the Proposed Development will not involve the removal or modification of any areas of the Lower Hunter Spotted Gum – Ironbark Forest 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 Modification Area does not support any critical habitat for the Lower Hunter Spotted Gum – Ironbark Forest 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 the Lower Hunter Spotted Gum – Ironbark Forest EEC and the Proposed 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the

implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

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 low abundance, principally in the northern part of the Stage 3 Modification Area, in Lower Hunter Spotted Gum – Ironbark Forest. This threatened flora species is also known to be widespread within the large remnant of the adjoining Werakata State Conservation Area.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats. Therefore there is very low potential for an impact on this species which occurs in dry habitats on slopes and ridges. The Proposed Development will not have an adverse effect on the life cycle of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) such that a viable local population of the species is likely to be placed at risk of extinction.

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

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

Habitat for the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the Stage 3 Modification Area will not be removed or modified as a result of the Proposed Development.

There is no potential for the habitats this species occurs within to be impacted by subsidence.

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

As there will be no removal or modification of habitat for the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the Stage 3 Modification Area, there is no potential that any habitats will be fragmented or isolated.

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 small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) occurs in the Lower Hunter Spotted Gum – Ironbark Forest in the Stage 3 Modification Area, where it occurs in low abundance. Known and potential habitat for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) occurs widely within the locality, including within Werakata State Conservation Area which occurs within and adjacent to the Stage 3 Modification Area. These habitats are similar in, and in many cases, higher in conservation significance than those habitats of the Stage 3 Modification Area.

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

The Stage 3 Modification Area 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 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

4.0 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 low abundance, principally in the northern part of the Stage 3 Modification Area, in Lower Hunter Spotted Gum – Ironbark Forest. This threatened flora species is also known to be widespread within the large remnant of the adjoining Werakata State Conservation Area.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats. Therefore there is very low potential for an impact on this species which occurs in dry habitats on slopes and ridges. The Proposed Development will not have an adverse effect on the life cycle of heath wrinklewort (*Rutidosis heterogama*) such that a viable local population of the species is likely to be placed at risk of extinction.

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

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

Habitat for the heath wrinklewort (*Rutidosis heterogama*) within the Stage 3 Modification Area will not be removed or modified as a result of the Proposed Development. There is no potential for the habitats this species occurs within to be impacted by subsidence.

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

As there will be no removal or modification of habitat for the heath wrinklewort (*Rutidosis heterogama*) within the Stage 3 Modification Area, there is no potential that any habitats will be fragmented or isolated.

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 heath wrinklewort (*Rutidosis heterogama*) occurs in the Lower Hunter Spotted Gum – Ironbark Forest in the Stage 3 Modification Area, where it occurs in low abundance. Known and potential habitat for heath wrinklewort (*Rutidosis heterogama*) occurs widely within the locality, including within Werakata State Conservation Area which occurs within and adjacent to the Stage 3 Modification Area. These habitats are similar in, and in many cases, higher in conservation significance than those habitats of the Stage 3 Modification Area.

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

The Stage 3 Modification Area 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 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

5.0 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 riparian habitats of the Stage 3 Modification Area provide potential habitat for the green-thighed frog (*Litoria brevipalmata*).

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Based on the subsidence predictions summarised in **Section 7**, it is not likely that the Proposed Development will result in the loss or modification of any areas of potential habitat for the green-thighed frog (*Litoria brevipalmata*) and therefore a viable local population of the species will not 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 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 Development is expected to have only very minor surface impacts, and will not result in the disturbance to any characteristics of the potential habitat for the green-thighed frog (*Litoria brevipalmata*). Areas 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 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 riparian habitats of the Stage 3 Modification Area comprise 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 Modification 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 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

6.0 Swift parrot (*Lathamus discolor*)

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 Modification Area provides suitable habitat for the swift parrot (*Lathamus discolor*), in particular within the Lower Hunter Spotted Gum – Ironbark Forest which supports winter flowering tree species that are known to be used by this species. Suitable foraging resources also occur elsewhere throughout the Stage 3 Modification Area. Moderate to high conservation value habitat for this species also occurs in the large remnant of the adjoining Werakata State Conservation Area. This highly mobile species is known to forage at a number of suitable locations within the locality in the cooler months.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats. As such, there is very low potential for an impact on the swift parrot (*Lathamus discolor*).

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

There will be no vegetation loss as a result of direct clearing, or as a result of subsidence impacts associated with the Proposed Development. There will no removal or modification of potential habitats for the swift parrot (*Lathamus discolor*).

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 Development is expected to have only very minor surface impacts, and will not result in the disturbance to any characteristics of the potential habitat for the swift parrot (*Lathamus discolor*). Areas 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 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 Modification Area provides moderate conservation value habitat for the swift parrot (*Lathamus discolor*). Known and potential habitat for the swift parrot (*Lathamus discolor*) is moderately widespread within the locality, including within Werakata State Conservation Area which occurs within and adjacent to the Stage 3 Modification Area. There are a number of areas of high conservation habitat within the region, only some of which are conserved.

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

The Stage 3 Modification Area does not support any critical habitat for the swift parrot (*Lathamus discolor*) 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

The key actions from the swift parrot recovery plan (Swift Parrot Recovery Team 2001) are summarised below:

- Identify and map priority foraging habitats and to identify important breeding sites.
- Implement a strategy to protect priority sites and habitats.
- Identify degraded habitats that have potential to benefit the recovery of the swift parrot.
- Monitor collisions and collision hazards, particularly during the breeding season.
- Monitor the density of the breeding population and the extent and quality of habitat.
- Increase public awareness about the recovery program.
- Involve the community in the recovery.

None of the above recovery actions would be compromised as a result of the Proposed Development. However, the Proposed Development does have scope to contribute information to some of these actions through the outcomes of ecological surveys and ongoing monitoring programs in habitats for the swift parrot (*Lathamus discolor*).

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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

7.0 Regent honeyeater (*Anthochaera phrygia*)

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 Modification Area provides suitable habitat for the regent honeyeater (*Anthochaera phrygia*), in particular within the Lower Hunter Spotted Gum – Ironbark Forest which supports winter flowering tree species that are known to be used by this species. Suitable foraging resources also occur elsewhere throughout the Stage 3 Modification Area. Moderate to high conservation value habitat for this species also occurs in the large remnant of the adjoining Werakata State Conservation Area. This highly mobile species is known to forage at a number of suitable locations within the locality in the cooler months.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats. As such, there is very low potential for an impact on the regent honeyeater (*Anthochaera phrygia*).

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

There will be no vegetation loss as a result of direct clearing, or as a result of subsidence impacts associated with the Proposed Development. There will no removal or modification of potential habitats for the regent honeyeater (*Anthochaera phrygia*).

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 Development is expected to have only very minor surface impacts, and will not result in the disturbance to any characteristics of the potential habitat for the regent honeyeater (*Anthochaera phrygia*). Areas 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 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 Modification Area provides moderate conservation value habitat for the regent honeyeater (*Anthochaera phrygia*). Known and potential habitat for the regent honeyeater (*Anthochaera phrygia*) is moderately widespread within the locality, including within Werakata State Conservation Area which occurs within and adjacent to the Stage 3 Modification Area. There are a number of areas of high conservation habitat within the region, only some of which are conserved.

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

The Stage 3 Modification Area does not support any critical habitat for the regent honeyeater (*Anthochaera phrygia*) 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

The specific recovery actions from the Regent Honeyeater Recovery Plan (Department of Natural Resources and Environment 1999) are:

- effectively organise and administer the recovery effort;
- maintain and enhance habitat;
- monitor trends in population size and range;
- facilitate strategic research;
- maintain and increase community awareness, understanding and involvement; and
- maintain the captive population.

None of the above recovery actions would be compromised as a result of the Proposed Development. However, the Proposed Development does have scope to contribute information to some of these actions through the outcomes of ecological surveys and ongoing monitoring programs in habitats for the regent honeyeater (*Anthochaera phrygia*).

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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

8.0 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 (*Pteropus poliocephalus*) has potential to occur in the Stage 3 Modification Area and potentially forages within the riparian habitats.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats. The Proposed 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 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 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 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 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 Modification Area comprises suitable foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*). One individual was seen flying over the surface infrastructure site (Umwelt 2008), however there are no known roost sites for this species within the Stage 3 Modification Area or the locality.

Given that the Proposed 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 Modification 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 Development.

The Draft National Recovery Plan for the Grey-Headed Flying-Fox (Department of Environment, Climate Change and Water 2009) lists the following priority actions:

- identify and protect foraging habitat critical to the survival of grey-headed flying-foxes;
- enhance winter and spring foraging habitat for grey-headed flying-foxes;
- identify, protect and enhance roosting habitat critical to the survival of grey-headed flying-foxes;
- significantly reduce levels of deliberate grey-headed flying-fox destruction associated with commercial horticulture;
- provide information and advice to managers, community groups and members of the public that are involved with controversial flying-fox camps;
- produce and circulate educational resources to improve public attitudes toward grey-headed flying-foxes, promote the recovery program to the wider community and encourage participation in recovery actions;

- monitor population trends for the grey-headed flying-fox;

- assess the impacts on grey-headed flying-foxes of electrocution on powerlines and entanglement in netting and barbed wire, and implement strategies to reduce these impacts;

- oversee a program of research to improve knowledge of the demographics and population structure of the grey-headed flying-fox; and

- maintain a National Recovery Team to oversee the implementation of the grey-headed flying-fox National Recovery Plan.

None of the above recovery actions would be compromised as a result of the Proposed Development. However, the Proposed Development does have scope to contribute information to some of these actions through the outcomes of ecological surveys and ongoing monitoring programs in habitats for the grey-headed flying-fox (*Pteropus poliocephalus*).

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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

9.0 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 large-footed myotis (*Myotis adversus*) was recorded in the Stage 3 Modification Area, and potentially forages within riparian habitats.

Subsidence modelling and predictions indicate that subsidence will occur relatively uniformly across the Stage 3 Modification area, and therefore the Proposed Development will cause very little disturbance of surface and groundwater flow patterns. The secondary impacts of subsidence typically have greatest impact on riparian areas, and these secondary impacts are also predicted to be minor. There will be no loss of vegetation as a result of direct clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

It is not likely that Proposed Development will result in the loss or modification of any areas of habitat for this species. The Proposed Development will 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 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

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 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 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 Modification 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 Modification 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 most relevant to the Proposed 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 7.8** of the main report. Given that the predicted surface impacts of the Proposed Development will be very minor, the implications of these KTPs are not constraining, however this would need to be continually reviewed and managed as mining progresses.

10.0 Conclusion

The Proposed Development will not result in a significant impact on any threatened species, populations or EECs recorded or potentially occurring within the Stage 3 Modification Area.

APPENDIX D

Assessment of Significance (EPBC Act)

Appendix D – Assessment of Significance (EPBC Act)

A search of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 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 Stage 3 Modification Area. No EPBC Act listed endangered populations or threatened ecological communities (TECs) are known or have potential to occur within the Stage 3 Modification Area.

Given that the Proposed Development comprises underground mining which is predicted to have very minor impacts on surface habitats, an assessment was only undertaken for those species regarded to have reasonable potential to occur and reasonable potential to be impacted by the Proposed Development. Consequently, only five threatened species and four migratory species require assessment. An assessment of the potential impacts of the Proposed Development on these species is provided below.

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 Stage 3 Modification 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 endangered species are considered in this assessment:

- swift parrot (*Lathamus discolor*); and
- regent honeyeater (*Anthochaera phrygia*).

An assessment in accordance with the DSEWPC 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 swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*) were not recorded in the Stage 3 Modification Area, however have potential to occur. Both are migratory species, and are known to occur in the locality in the cooler months where they forage on winter-flowering resources such as spotted gum (*Corymbia maculata*) and ironbarks (*Eucalyptus* spp.).

Under the above definition of a *population*, any records of the swift parrot (*Lathamus discolor*) within the Stage 3 Modification Area would be considered a *population*. All records of swift parrot in Australia are regarded to be from the same population as they all breed in the one location.

In the case of the regent honeyeater (*Anthochaera phrygia*), there are at least three distinct breeding areas, and it is now thought that there is a loose Hunter population also, with records of the species breeding at a location to the east of the Stage 3 Modification Area. As such, any records of the regent honeyeater (*Anthochaera phrygia*) within the Stage 3 Modification Area would also be considered a part of a *population* in accordance with the above EPBC Act definitions.

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 (*Anthochaera phrygia*) were recorded within the Stage 3 Modification Area, however there is potential for both species to occur, in particular in the Lower Hunter Spotted Gum – Ironbark Forest community. As these species are winter migrants, they would utilise the resources of the Stage 3 Modification Area as part of a wider foraging range at appropriate times of the year. The Proposed Development will not result in the loss of vegetation as a result of direct clearing or as a secondary impact of subsidence. The subsidence predictions indicate that any modifications to surface habitats resulting from subsidence would be minor, and almost exclusively restricted to riparian areas. As such, there is no potential for the Proposed Development to lead to a long-term decrease in the size of a population of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*).

- **reduce the area of occupancy of the species; or**

No populations of swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the Stage 3 Modification Area, however it does support potential habitat for both species. Given that surface impacts will be minor, the Proposed Development will not reduce the area of potential habitat for these endangered species, and sizeable 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*) or regent honeyeater (*Anthochaera phrygia*) were recorded within the Stage 3 Modification Area, however potential foraging habitat for these migratory species is present. Given that the proposal is underground and will cause minor disturbances to surface habitats, there is no potential for it to lead to the fragmentation of 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 (*Anthochaera phrygia*) were recorded within Stage 3 Modification Area. The Stage 3 Modification Area is not known to support any areas of critical habitat for either species. The Proposed Development will not adversely affect habitat critical to the survival of these endangered species.

- **disrupt the breeding cycle of a population; or**

Potential foraging habitat for the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*) occurs within the Stage 3 Modification Area, however there is no known breeding habitat. The Proposed Development does not involve any clearing of habitats or fragmentation of habitats. As such, the Proposed 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**

Potential foraging habitat for the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*) occurs within the Stage 3 Modification Area, in particular within the Lower Hunter Spotted Gum – Ironbark Forest community. The Proposed Development is underground and will result in minor surface disturbances that are not expected to alter the habitats of the two endangered species. Consequently, the Proposed Development will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that these endangered species are 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**

Given that the Proposed Development is underground and will have minimal surface impacts, it is not expected to result in the establishment of invasive species that are harmful to these endangered species.

- **interfere with the recovery of the species.**

The Proposed Development will not lead to the loss of, alteration of or fragmentation of potential foraging habitats for the swift parrot (*Lathamus discolor*) or regent honeyeater (*Anthochaera phrygia*). As such, the Proposed Development will not interfere with the recovery of either species.

Vulnerable Flora Species

The following EPBC Act listed vulnerable flora species are considered in this assessment:

- heath wrinklewort (*Rutidosis heterogama*); and
- small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

An assessment in accordance with the DSEWPC 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.

The heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) were both recorded in the Stage 3 Modification Area. The Stage 3 Modification Area does not support an important population of either species, based on the above definition.

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 Stage 3 Modification Area supports known habitat for heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), however it does not support an important population of either of these species. The Proposed Development involves underground mining and as such there will be only minor surface impacts. Based on subsidence modelling and predictions, there will be no alteration to habitats of the heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), both of which occur on the drier slopes and ridges, predominantly in the north of the Stage 3 Modification Area. As such, there is no potential for the Proposed Development to lead to a long-term decrease in the size of a population of either species.

- **reduce the area of occupancy of an *important population*; or**

As described above, the Proposed Development will not involve any activities that would alter the habitats of the heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). As such, there is no potential for the Proposed Development to lead to a reduction in the area of occupancy of a population of either species.

- **fragment an existing important population into two or more populations; or**

Given that any surface disturbances associated with the Proposed Development would only be minor, there is no potential for existing populations of heath wrinklewort (*Rutidosis*

heterogama) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) to become fragmented or isolated.

- **adversely affect habitat critical to the survival of a species; or**

The Stage 3 Modification Area does not contain any habitats that are critical to the survival of heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). Regardless, there will not be any modifications to the habitats of these species as a result of the Proposed Development.

- **disrupt the breeding cycle of an important population; or**

The Proposed Development does not comprise any actions that would disrupt the breeding cycle of heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline; or**

The Stage 3 Modification Area supports known habitat for heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), however it does not support an important population of either of these species. The Proposed Development involves underground mining and as such there will be only minor surface impacts. Based on subsidence modelling and predictions, there will be no alteration to habitats of the heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), both of which occur on the drier slopes and ridges, predominantly in the north of the Stage 3 Modification Area. As such, there is no potential for the Proposed Development to modify, destroy, remove, isolate or decrease the availability or quality of habitat for either species to the extent that they would be likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

Given that the Proposed Development is underground and will have minimal surface impacts, it is not expected to result in the establishment of invasive species that are harmful to these endangered species.

- **interfere substantially with the recovery of the species.**

The Proposed Development will not lead to the loss of, alteration of or fragmentation of habitats for heath wrinklewort (*Rutidosis heterogama*) or small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*). As such, the Proposed Development will not interfere with the recovery of either species.

Vulnerable Fauna Species

An assessment in accordance with the DSEWPC 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*) has potential to occur in the Stage 3 Modification Area, and this species potentially forages in riparian habitats. No roost sites for this species occur in the Stage 3 Modification Area. Based on the definition described above, the Stage 3 Modification Area does not support an important population of this species. It is expected that individuals of this highly mobile species would utilise the resources of the Stage 3 Modification Area as part of a wider foraging range, and no populations would specifically or solely rely on these resources.

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 Stage 3 Modification Area provides potential foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*), however it does not support an important population of this species under the above definition.

The Proposed Development involves underground mining and as such there will be only minor surface impacts, with slightly more potential for impacts in riparian areas. Any potential loss of foraging resources for the grey-headed flying-fox (*Pteropus poliocephalus*) is expected to be very minor and would not have potential to lead to a decrease in the size of a population of this species.

- **reduce the area of occupancy of an *important population*; or**

The Proposed Development will not disturb or modify any areas of habitat for the grey-headed flying fox (*Pteropus poliocephalus*). The Stage 3 Modification Area does not comprise an important population for this species.

The Proposed Development involves underground mining and as such there will be only minor surface impacts, with slightly more potential for impacts in riparian areas. Any potential loss of foraging resources for the grey-headed flying-fox (*Pteropus poliocephalus*) is expected to be very minor and would not have potential to lead to a reduction in the area of occupancy of this species.

- **fragment an existing important population into two or more populations; or**

Given that any surface disturbances associated with the Proposed Development would only be minor, there is no potential for the existing population of grey-headed flying-fox (*Pteropus poliocephalus*) to become fragmented or isolated.

- **adversely affect habitat critical to the survival of a species; or**

The Stage 3 Modification 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 Modification Area.

- **disrupt the breeding cycle of an important population; or**

The Stage 3 Modification Area does not support any important population for the grey-headed flying-fox (*Pteropus poliocephalus*). The Proposed Development does not comprise any actions that would disrupt the breeding cycle of 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**

The Stage 3 Modification Area provides foraging habitat for the grey-headed flying-fox (*Pteropus poliocephalus*), however it does not support an important population of this species under the above definition.

The Proposed Development involves underground mining and as such there will be only minor surface impacts, with slightly more potential for impacts in riparian areas. There is no potential for the Proposed Development to modify, destroy, remove, isolate, or decrease the availability or quantity of habitat for the grey-headed flying-fox (*Pteropus poliocephalus*) to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat; or**

Given that the Proposed Development is underground and will have minimal surface impacts, it is not expected to result in the establishment of invasive species that are harmful to these endangered 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. However, those within the Stage 3 Modification Area are highly modified and not as high quality as those protected in Werakata State Conservation Area. Due to the very minor surface impacts predicted, the Proposed 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:

- great egret (*Ardea modesta*);
- cattle egret (*Ardea ibis*);
- regent honeyeater (*Anthochaera phrygia*); and
- swift parrot (*Lathamus discolor*).

An assessment in accordance with the DSEWPC 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 Modification Area, however there is potential habitat for these species to occur. The Stage 3 Modification Area is not regarded to be *important habitat* for the great egret (*Ardea modesta*), the cattle egret (*Ardea* ibis), the swift parrot (*Lathamus discolor*) or the regent honeyeater (*Anthochaera phrygia*).

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 Development will not result in the loss of vegetation as a result of direct clearing or as a secondary impact of subsidence. The subsidence predictions indicate that any modifications to surface habitats resulting from subsidence would be minor, and almost exclusively restricted to riparian areas. There is no potential for the Proposed Development to result in a substantial modification, destruction or isolation of habitats for any of the above listed 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**

Given that the Proposed Development is underground and will have minimal surface impacts, it is not expected to result in the establishment of invasive species that are harmful to these migratory species.

- **seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species**

The nature of the Proposed Development is such that there will be very minor disturbances to surface vegetation and habitats within the Stage 3 Modification Area. As such, there is no potential that the lifecycle of any migratory species could be seriously disrupted. There is no potential that an ecologically significant proportion of the population of any of these migratory species could be affected by the Proposed Development.

Conclusion

The Proposed Development will not result in a significant impact on any EPBC Act listed threatened species or migratory species.

APPENDIX E

Fauna Species List

Appendix E – Fauna Species List

The following list was developed from surveys as detailed in **Section 3** of the main report. It includes all fauna species observed in the original Stage 3 Mine Area (as reported in Umwelt 2008b), as well as the proposed Stage 3 Modification Area in which supplementary surveys were undertaken for the current assessment. As the proposed Stage 3 Modification Area overlaps with most of the original Stage 3 Mine Area, many of the species recorded for Umwelt 2008b would also be present in the modified mine plan area.

All threatened species are indicated in **bold** type.

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not indigenous to the Stage 3 Modification 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 (2002), 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 Original Stage 3 Mine Area (Umwelt 2008b) and the Stage 3 Modifications Mine Area

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
BIRDS					
Anatidae					
Cygnus atratus	black swan		MIG	X	
Chenonetta jubata	Australian wood duck		MIG	X	X
Anas superciliosa	Pacific black duck		MIG		X
Anas gracilis	grey teal				X
Podicipedidae					
Tachybaptus novaehollandiae	Australasian grebe				X
Phalacrocoracidae					
Phalacrocorax melanoleucos	little pied cormorant			X	
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		X
Falconidae					
Falco cenchroides	nankeen kestrel		MAR &MIG	X	
Rallidae					
Porphyrio porphyrio	purple swamphen			X	X
Gallinula tenebrosa	dusky moorhen				X
Fulica atra	Eurasian coot				X
Charadriidae					
Vanellus miles	masked lapwing		MIG	X	X
Columbidae					
Ocyphaps lophotes	crested pigeon			X	X

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
Leucosarcia melanoleuca	wonga pigeon				X
Phaps chalcoptera	common bronzewing			X	X
Cacatuidae					
Cacatua roseicapilla	galah			X	X
Calyptorhynchus funereus	yellow-tailed black-cockatoo				
Callocephalon fimbriatum	**gang-gang cockatoo**	**V**			**X**
Cacatua tenuirostris	long-billed corella			X	
Cacatua galeria	sulphur-crested cockatoo			X	
Psittacidae					
Glossopsitta concinna	musk lorikeet				X
Glossopsitta pusilla	**little lorikeet**	**V**			**X**
Platycercus eximius	eastern rosella			X	X
Trichoglossus haematodus	rainbow lorikeet				X
Trichoglossus chlorolepidotus	scaly-breasted lorikeet				X
Psephotus haematonotus	red-rumped parrot				X
Strigidae					
Ninox strenua	**powerful owl**	**V**			X
Ninox noveseelandiae	southern boobook				X
Podargidae					
Podargus strigoides	tawny frogmouth				X
Alcedinidae					
Ceyx azureus	azure kingfisher			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
Sericornis frontalis	white-browed scrubwren				X
Chthonicola sagittatus	**speckled warbler**	**V**			X
Acanthiza chrysorrhoa	yellow-rumped thornbill				X
Acanthiza lineata	striated thornbill				X

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
Acanthiza nana	yellow thornbill			X	
Acanthiza pusila	brown thornbill			X	
Meliphagidae					
Acanthorhynchus tenuirostris	eastern spinebill			X	
Anthochaera carunculata	red wattlebird			X	X
Entomyzon cyanotis	blue-faced honeyeater				
Manorina melanocephala	noisy miner			X	X
Lichenostomus ornatus	yellow-plumed honeyeater				X
Lichenostomus penicillatus	white-plumed honeyeater				
Lichenostomus chrysops	yellow-faced honeyeater				X
Lichenostomus melanops	yellow-tufted honeyeater				X
Lichenostomus fuscus	fuscous honeyeater				X
Philemon corniculatus	noisy friarbird			X	X
Meropidae					
Merops ornatus	rainbow bee-eater		**MAR & MIG**		X
Climacteridae					
Climacteris leucophaea	white-throated treecreeper				X
Pachycephalidae					
Colluricincla harmonica	grey shrike-thrush				
Petroicidae					
Microeca leucophaea	Jacky winter				
Petroica goodenovii	red-capped robin				
Petroica boodang	**scarlet robin**	**V**			**X**
Pomatostomidae					
Pomatostomus temporalis temporalis	**grey-crowned babbler (eastern subspecies)**	**V**			X
Neosittidae					
Pachycephala pectoralis	golden whistler				
Pachycephala rufiventris	rufous whistler				X
Dicruridae					
Myiagra cyanoleuca	satin flycatcher		**MAR &MIG**		X

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
Grallina cyanoleuca	magpie-lark		MAR	X	X
Rhipidura leucophrys	willie wagtail			X	
Rhipidura fuliginosa	grey fantail				X
Campephagidae					
Coracina novaehollandiae	black-faced cuckoo-shrike		MAR		X
Oriolidae					
Oriolus sagittatus	olive-backed oriole				
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
Corcoracidae					
Corcorax melanorhamphos	white-winged chough			X	X
Motacillidae					
Anthus novaeseelandiae	Richards pipit		MAR		
Passeridae					
Taeniopygia bichenovii	double-barred finch				X
Hirundinidae					
Hirundo neoxena	welcome swallow		MAR		X
Sturnidae					
**Sturnus tristus*	common myna			X	
REPTILES					
Agamidae					
Amphibolurus muricatus	Jacky lizard				
Physignathus lesueurii	eastern water dragon				X
Pogona barbata	bearded dragon			X	
Cheloniidae					
Emydura macquarii	Macquarie turtle				X
Scincidae					
Eulamprus quoyii	eastern water skink				X

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
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	X
Uperoleia laevigata	smooth toadlet				X
Hylidae					
Litoria fallax	dwarf tree frog			X	X
Litoria latopalmata	broad-palmed frog				X
Litoria peronii	Perons tree frog				X
Litoria tyleri	Tylers tree frog			X	X
Litoria verreauxii	Verreauxs tree frog				X
MAMMALS					
Phalangeridae					
Trichosurus vulpecula	common brushtail possum				X
Macropodidae					
Macropus giganteus	eastern grey kangaroo			X	X
Molossidae					
Nyctinomus australis	white-striped freetail-bat				X
Mormopterus norfolkensis	**eastern freetail-bat**	**V**			X
Vespertilionidae					
Miniopterus australis	**little bentwing-bat**	**V**			X
Miniopterus schreibersii oceanensis	**eastern bentwing-bat**	**V**			X
Nyctophilus sp.	-				X
Chalinolobus gouldii	Goulds wattled bat				X
Chalinolobus morio	chocolate wattled bat				X
Myotis adversus	**large-footed myotis**	**V**			X
Falsistrellus tasmaniensis	**eastern false-pipistrelle**	**V**			X
Scotorepens balstoni	inland broad-nosed bat				poss.
Scotorepens orion	eastern broad-nosed bat				X

Scientific Name	Common Name	Conservation Status			
		TSC Act	EPBC Act	Stage 3 Mine Area – Modifications Survey Sept 2010	Stage 3 Mining Area (Umwelt 2008b)
Vespadelus pumilus	eastern forest bat				X
Vespadelus vulturnus	little forest bat				X
Petauridae					
Petaurus breviceps	sugar glider				X
Petaurus norfolcensis	**squirrel glider**	**V**			X
Dasyuridae					
Antechinus stuartii	brown antechinus				X
Antechinus flavipes	yellow-footed antechinus				X
Vombatiae					
Vombatus ursinus	common wombat				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	X

Umwelt (Australia) Pty Limited
2/20 The Boulevarde
PO Box 838
Toronto NSW 2283

Ph. 02 4950 5322
Fax 02 4950 5737