APPENDIX 4

Ecological Assessment

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AUSTAR COAL MINE
PART OF THE YANCOAL AUSTRALIA GROUP

AUSTAR COAL MINE LWA7-A10 MODIFICATION – STAGE 3 AREA

ECOLOGICAL ASSESSMENT

October 2013

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ECOLOGICAL ASSESSMENT

October 2013

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Austar Coal Mine Pty Ltd

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Report No.	**3264/R03/FINAL**
Date:	**October 2013**

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1.0 Introduction

Austar Coal Mine Pty Ltd (Austar) is seeking approval to modify the currently approved Stage 3 longwall mining operations for Austar Coal Mine, located approximately 10 kilometres south of Cessnock in the lower Hunter Valley in New South Wales (**Figure 1.1**). The modification is limited to a change in the underground longwall layout of LW A7 to A10. No other changes to existing approved mining operations are proposed.

Umwelt (Australia) Pty Limited (Umwelt) was commissioned by Austar to complete an Ecological Assessment for the Proposed LWA7-A10 Modification, as part of a larger Environmental Assessment.

The ecological survey and assessment reported herein was undertaken generally in accordance with the requirements of the NSW *Threatened Species Conservation Act 1995* (TSC Act), the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Fisheries Management Act 1994* (FM Act), State Environmental Planning Policy 44 (SEPP 44) – Koala Habitat Protection and the *Threatened Species Survey and Assessment: Guidelines for development and activities* (working draft) (DEC 2004).

1.1 Background

The Austar Coal Project (08_0111) for the Stage 3 underground mining area, was approved by the NSW Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 6 September 2009. Two subsequent modifications to Project Approval 08_0111 have been approved providing for changes to the approval conditions and reorientation of the longwall mine plan. Approval for the Proposed Modification will be sought under Section 75W of the EP&A Act.

1.2 Project Description

Austar is seeking to modify Project Approval 08_0111 to allow for the extension of longwalls A7 to A10 in the Austar Coal Mine Stage 3 mining area (**Figure 1.2**). The scope of the Proposed LWA7–A10 Modification is limited to the extension of longwalls A7 to A10 by between approximately 100 and 300 metres to the west. Further Austar is proposing to retract the starting position of longwall A8 (**Figure 1.2**), in accordance with Condition 3 of the existing Project Approval. The proposed westerly extension to the four longwalls provides access to an additional 1.05 million tonnes of ROM coal.

No other changes to the approved Stage 3 mining operations are proposed as part of the modification.

The Proposed LWA7–A10 Modification will result in a minor increase (1.8% or approximately 22 hectares) in the area of land affected by subsidence, however, the maximum predicted subsidence parameters for the Proposed LWA7–A10 Modification are similar to those for the approved Stage 3 mine plan.

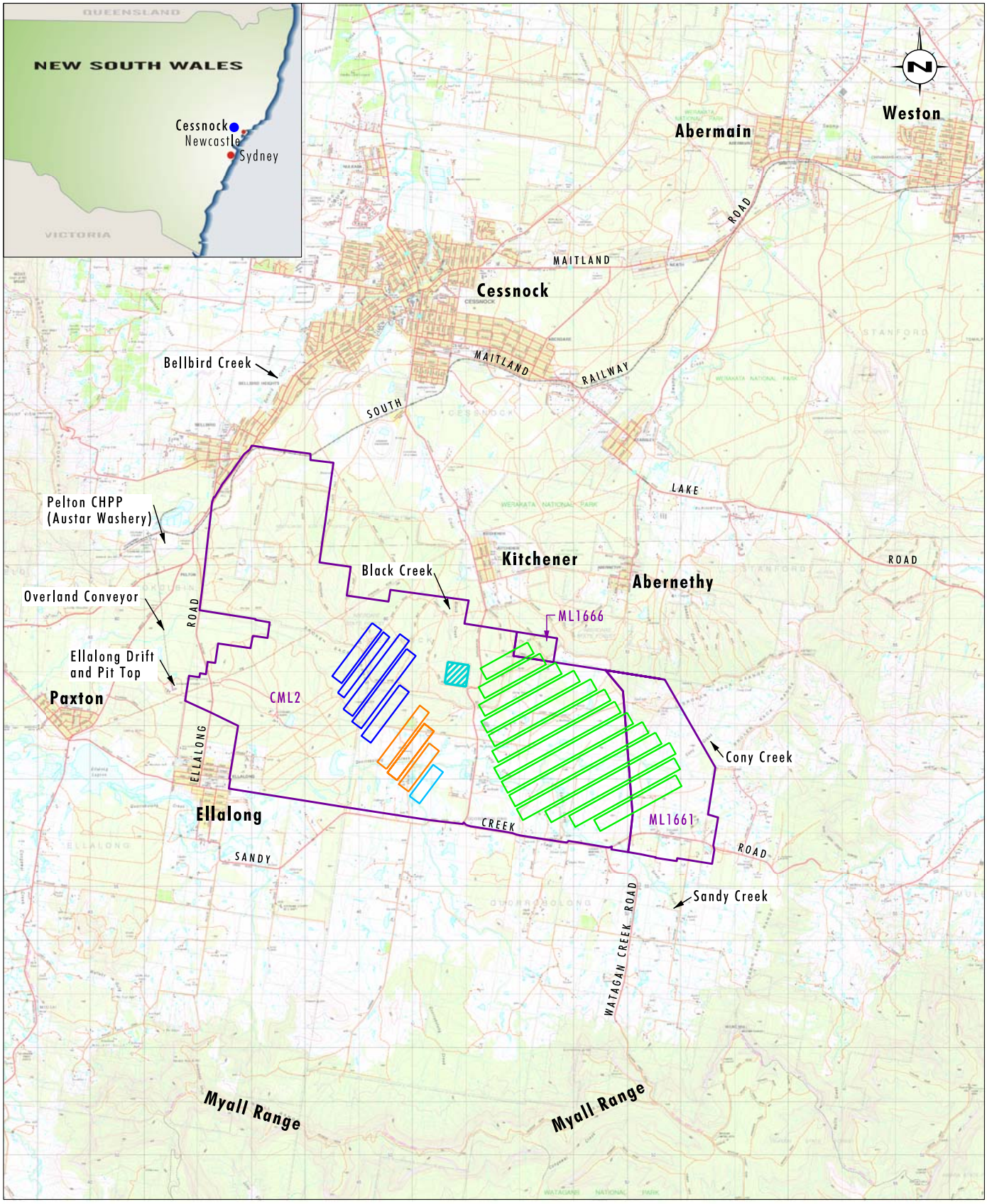

Image Source: LPI NSW (2009)
Data Source: Austar Coal Mine (2013)

0 1.0 2.5 5.0km
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Legend

- Layout for Stage 1 Longwall Panels (complete)
- Layout for Stage 2 Longwall Panels (complete)
- Layout for Stage 2 Extension Longwall Panels (complete)
- Layout for Approved Stage 3 Longwall Panels
- Approved Surface Infrastructure Site
- Mining Lease Boundary

FIGURE 1.1

Austar Mine Complex
Locality Plan

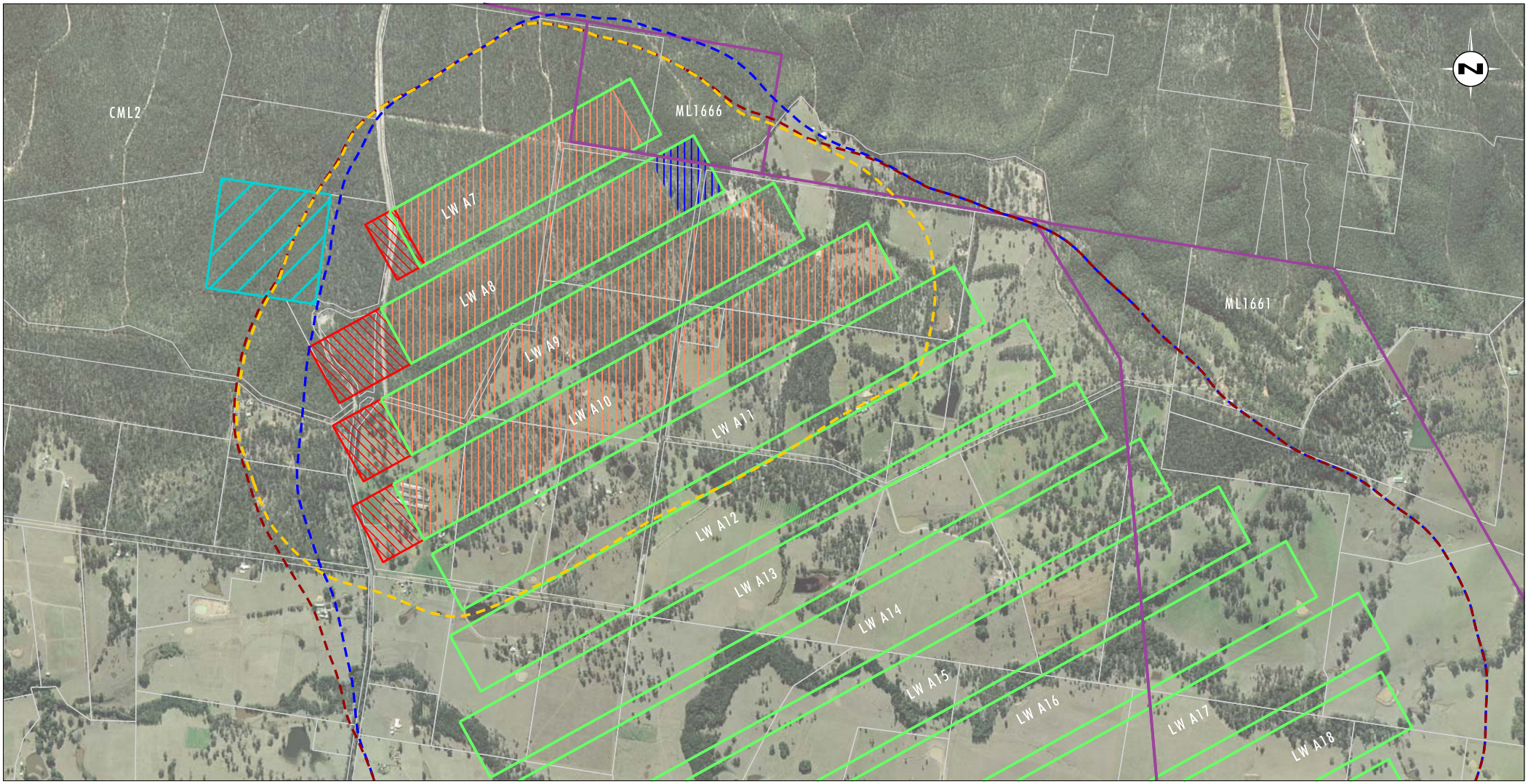

Image Source: AAM Hatch (2006),
Data Source: Austar Coal Mine (2013), LPI NSW (2010)

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Legend

- Layout for Approved Stage 3 Longwall Panels
- 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
- LW A7-A10 20mm Incremental Subsidence Contour (Proposed LW A7-A10 Modification Area)
- Revised 20mm Subsidence Contour for Modified Stage 3 Longwall Layout
- Approved Surface Infrastructure Site
- Mining Lease Boundary
- SMP Approved Longwall Layout
- Proposed Retraction of Longwall A8 Start Position
- Proposed Extension of Longwalls A7 to A10 Finish Position

FIGURE 1.2

Proposed LW A7-A10 Modification

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1.3 Environmental Setting

The Proposed LWA7–A10 Modification Area lies within the Sydney Basin Bioregion and the North Coast Botanical Subdivision.

The Proposed LWA7–A10 Modification Area in the south comprises areas of 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.

There are no permanently flowing tributaries that occur within the Proposed LWA7–A10 Modification Area. However Quorrobolong Creek, Sandy Creek and Cony Creek are all located within the same catchment area within 5 kilometres of the Proposed LWA7–A10 Modification Area.

There are two soil landscapes within the Proposed LWA7–A10 Modification Area, being the Quorrobolong soil landscape and the Aberdare soil landscape (Kovak and Lawrie 1991). The Quorrobolong 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.

Historically, much of the vegetation present has been logged and is now predominantly composed of relatively young native vegetation (estimated to be younger than sixty years old). The Proposed LWA7–A10 Modification Area are part of a much larger remnant of regrowth native vegetation (now comprising Werakata State Conservation Area and therefore habitats are well connected to others.

1.4 Objectives

The objectives of the Ecological Assessment were to:

- record flora and fauna species and ground-truth vegetation communities within the Proposed LWA7–A10 Modification Area;
- identify any threatened or migratory species, endangered populations, threatened ecological communities (TECs), or their habitats within the Proposed LWA7–A10 Modification Area, particularly those listed under the TSC Act and EPBC Act;
- identify any groundwater dependent ecosystems or riparian habitats occurring within the Proposed LWA7–A10 Modification Area;
- assess the potential impact of the Proposed LWA7–A10 Modification on any flora and fauna species, threatened species, endangered populations, TECs, groundwater dependent ecosystems, aquatic species or habitats recorded (or with potential to occur) in the Proposed LWA7–A10 Modification Area; and
- provide management options to minimise ecological impacts associated with the Proposed LWA7–A10 Modification Area.

2.0 Methods

Extensive field surveys were not deemed as necessary for the purposes of this Ecological Assessment as a result of the extensive level of ecological survey that has occurred across the Stage 3 underground mining area in the past (including Ecological Assessments (Umwelt 2008 and 2011a) as well as monitoring undertaken for the Stage 3 monitoring area in Spring 2012, Autumn and Spring 2013 (Umwelt in prep) and monitoring undertaken within the Stage 2 Mining Area biannually since 2008 (Umwelt 2009, 2010, 2011b, 2012 and 2013a). In addition to this, the impacts of the Proposed LWA7–A10 Modification are predicted to be limited to minor subsidence and secondary subsidence-related impacts, primarily due to depth of cover to coal seam (455 to 750 metres) (which typically have the greatest impact in riparian ecosystems) such as:

- changes to runoff and flow volumes through subsidence induced changes to catchment boundaries;
- changes to bank stability and channel alignment;
- changes to in-creek channel and out of channel ponding through changes to the bed profile of the creeks which may result in drying or water logging 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).

No clearing of vegetation will be required as part of the Proposed LWA7–A10 Modification. Regardless, a field inspection was undertaken in order to ground-truth the existing vegetation mapping and to identify any potential threatened species and habitat features present, or with the potential to occur in the Proposed LWA7–A10 Modification Area.

The survey methodology adopted during the field inspection was designed to gain a thorough understanding of the ecological features of the Proposed LWA7–A10 Modification Area and to build on existing ecological information for the area. The survey methodology included a review of existing relevant vegetation mapping (Bell 2004, Bell and Driscoll 2008, Umwelt 2008 and Umwelt 2011a), reports and literature as well as searches of relevant ecological databases, including the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database and Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Database, within a 10 kilometre radius from the centre of the Proposed LWA7–A10 Modification Area.

Information gathered from the review of previous literature, vegetation mapping and database searches was then used to design a field survey program to map vegetation communities and to target threatened species, endangered populations, TECs, and their habitats, that have potential to occur in the Proposed LWA7–A10 Modification Area.

The field inspection was conducted on 20 September 2013 by two Umwelt ecologists. Flora and fauna surveys were undertaken during the inspection. A detailed description of each survey methodology is outlined below.

2.1 Literature Review

A review of previous documents and reports relevant to the Proposed LWA7–A10 Modification Area were undertaken to inform the field survey methodology, results and impact assessment component of this report. This included regional vegetation mapping reports and also relevant ecological database searches. The information obtained was used

to inform survey design, and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations and TECs. Relevant documents are discussed in **Appendix A**.

2.2 Ecological Database Searches

In order to identify potential threatened and migratory species, endangered populations and TECs with the potential to occur in the Proposed LWA7–A10 Modification Area, a search of relevant ecological databases was completed during September 2013. These database sources comprised:

- a 10 kilometre radius search from the centre of the Proposed LWA7–A10 Modification Area of the OEH Atlas of NSW Wildlife (September 2013);
- a 10 kilometre radius search from the centre of the Proposed LWA7–A10 Modification Area of the DSEWPC Protected Matters Database (September 2013); and
- a search of the Department of Primary Industries Threatened and Protected Species Record Viewer (September 2013).

Records from these database searches were combined with records derived through literature reviews and professional opinion to identify the range of potentially occurring threatened and migratory species, endangered populations and TECs for the area. The results of the database searches are compiled in **Appendix B**.

Current lists of threatened species and key threatening processes were sourced from the OEH and DSEWPC websites in September 2013.

2.3 Flora Survey

Due to the extent of survey that had occurred throughout the Stage 3 Mining Area previously, extensive flora surveys were not deemed necessary for this Proposed LWA7–A10 Modification. Plot-based surveys were not undertaken as part of the field inspection, rather surveys consisted of meander transects and opportunistic records of flora species.

The purpose of flora surveys was to:

- target potentially occurring threatened flora species, endangered populations and threatened ecological communities (TECs) listed under the TSC Act and EPBC Act;
- ground-truth the existing vegetation community mapping for the area, with particular focus on identifying and mapping TECs in the Proposed LWA7–A10 Modification Area; and
- complete targeted searches for threatened flora species, particularly heath wrinklewort (*Rutidosis heterogama*) and small-flowered grevillea (*Grevillea parviflora* subsp. *parviflora*), both of which are known to occur in the surface infrastructure site and the broader local area.

All flora species that were readily identified in the field were recorded on field survey datasheets. All flora species that could not be immediately identified, as well as potential threatened flora species, were collected, dried and identified or sent to the National Herbarium of NSW for identification.

In addition, information was gathered on the condition of the vegetation of the Proposed LWA7–A10 Modification Area, including fire history and the density of weeds and any evidence of disturbance such as feral animals.

2.3.1 2013 Meander Transects

Walking meander transects were undertaken across the Proposed LWA7–A10 Modification Area by two Umwelt Ecologists over a 5 hour period over a distance of more than 3.5 kilometres, as shown in **Figure 2.1**. This form of survey is a method of flora data collection that enables the surveyor to sample flora across a much larger area than that sampled in systematic plots. However, the data collected is usually in the form of presence records, rather than semi-quantitative values, and therefore do not contribute as much to the delineation of vegetation communities. Notwithstanding this, walking transects are a valuable way of enabling wide spread coverage of an area in a fairly uniform landscape. Meander transects also facilitate the discovery of widely dispersed rare plant species such as heath wrinklewort (*Rutidosis heterogama*) and small-flowered grevillea (*Grevillea parviflora* subsp. *parviflora*).

2.3.2 2013 Plot-based Surveys

Two vegetation plots that have recently been surveyed as part of the Austar Stage 3 Biodiversity Management Plan monitoring program fall within the Proposed LWA7–A10 Modification Area (see **Figure 2.1**). Both plots are located in Spotted Gum - Ironbark Forest.

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 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 2.1**).

Table 2.1 – 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).

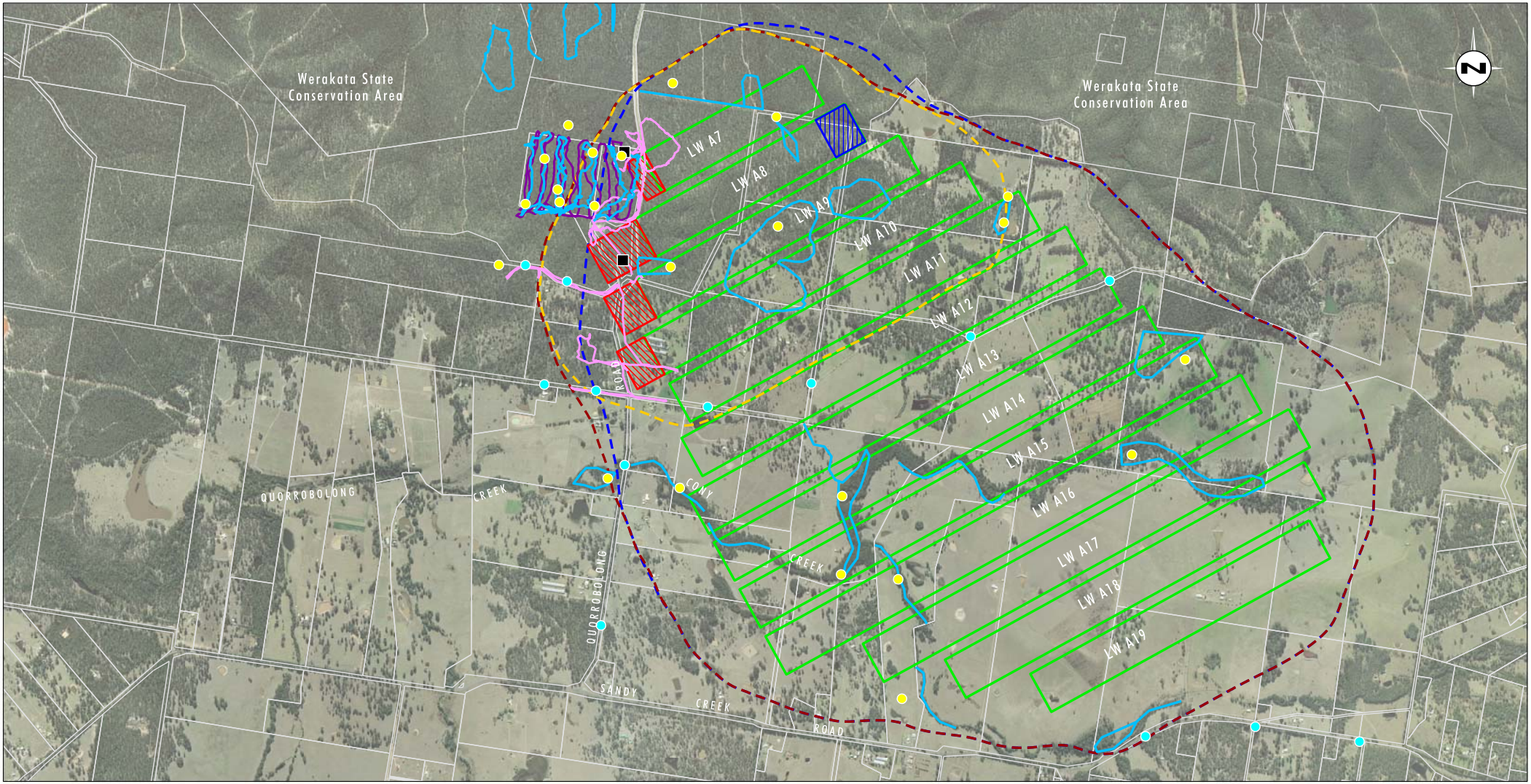

Image Source: AAM Hatch (2006)
Data Source: Austar Coal Mine (2013), LPI NSW (2009)

0 0.5 1.0 1.5km
1:30 000

Legend

- Layout for Approved Stage 3 Longwall Panels
- 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
- Proposed LW A7-A10 Modification Area
- Revised 20mm Subsidence Contour for Modified Stage 3 Longwall Layout
- Proposed Retraction of Longwall A8 Start Position
- Proposed Extension of Longwalls A7 to A10 Finish Position
- Targeted Threatened Flora Searches
- Vegetation Transect
- 2013 Meander Surveys
- 2013 Flora Plots
- Roadside Vegetation Assessment Point
- Quadrat Locations

FIGURE 2.1

Flora Survey Locations

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

2.3.3 Previous Flora Surveys Undertaken

A considerable amount of flora survey has been completed previously as part of the surveys for the Austar Stage 3 Mine Area (Umwelt 2008 and Umwelt 2011b) as detailed in **Appendix A**, and for the Austar Stage 3 Monitoring Surveys (Umwelt in Prep). These are shown on **Figure 2.1** and have contributed to a thorough understanding of the flora of the Austar Mine (in general). Previous flora surveys undertaken are summarised below:

- Systematic plot-based surveys;
- Transect Surveys; and
- Roadside Assessment Points.

2.3.4 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002) and Wheeler *et al*. (2002). Recent changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2013), the online plant name database maintained by the National Herbarium of New South Wales.

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

2.4 Fauna Survey

Due to the extent of survey that had occurred throughout the Stage 3 Mining Area previously, extensive fauna surveys were not deemed as necessary. However opportunistic observations were made of fauna species and habitat features throughout the site inspection.

Birds recorded were identified using descriptions in Slater *et al*. (2003) and the scientific and common name nomenclature and taxonomy adopted by BirdLife Australia. Reptiles recorded were identified using keys and descriptions in Cogger (2000), Swan *et al*. (2004), Wilson & Swan (2010) and the scientific and common name nomenclature and taxonomy adopted by Cogger (2000).

Amphibians recorded were identified using keys and descriptions in Cogger (2000), and Robinson (2002) and the scientific and common name nomenclature of Cogger (2000). Mammals recorded were identified using keys and descriptions in Strahan (2002), Churchill (2008) and Menkhorst & Knight (2011) and the scientific and common name nomenclature of Van Dyke and Strahan (2008).

Opportunistic fauna observations included:

- documentation of any significant fauna habitat features encountered (such as feed trees, hollow-bearing trees or hollow logs);
- completing opportunistic fauna surveys to record any species encountered in the area during the field inspection; and
- describing the condition of the habitat provided in the Proposed LWA7–A10 Modification Area, including any areas of aquatic habitat such as drainage lines or dams.

2.4.1 Previous Fauna Surveys Undertaken

A considerable amount of fauna survey has been completed previously as part of the surveys for the Austar Stage 3 Mine Area (Umwelt 2008 and Umwelt 2011b) as detailed in **Appendix A**. Previous fauna surveys undertaken are summarised below:

- fauna trapping;
- spotlighting and reptile and amphibian surveys;
- diurnal bird surveys;
- call playback surveys; and
- habitat assessment.

2.5 Habitat Assessment

General habitat-based information was collected throughout the duration of the field inspection. Habitat data collected included:

- evidence of disturbance such as fire, weeds, feral animals, dumping, erosion and logging;
- presence of fallen timber/logs;
- presence of stumps and stags;
- presence of groundcover features such as rock, litter, grasses, logs, boulder, soil and lichen;
- presence of insect attack; and
- vegetation composition.

General observations about the habitat present were also undertaken.

2.5.1 State Environmental Planning Policy (SEPP) 44 (Koala Habitat) Assessment

An application for a proposed development approval which relates to a site occurring within a local government area (LGA) specified under State Environmental Planning Policy 44 (SEPP 44) – Koala Habitat Protection, 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 (refer to **Table 2.2**) constitute 15 per cent or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

Table 2.2 – Eucalypt Species Listed Under Schedule 2 of SEPP 44

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

Cessnock LGA is a specified SEPP 44 LGA and consequently SEPP 44 assessment is required. SEPP 44 assessment was undertaken based upon past plot data collected as part of Umwelt (2008) and Umwelt (2011). Additionally, observations were made throughout 2013 surveys for appropriate koala habitat trees and koala presence, with dominant canopy species recorded at regular intervals throughout the entirety of the survey.

3.0 Flora Results

The following sections describe the floristic diversity and vegetation communities identified in the Proposed LWA7–A10 Modification Area, in addition to any significant ecological values such as threatened flora species, endangered populations or TECs.

3.1 Flora Species

A full list of flora species recorded in the Proposed LWA7–A10 Modification Area and as part of surveys undertaken for Umwelt (2008) and Umwelt (2010) are provided in **Appendix C**. A total of 317 flora species have been recorded across the three different projects and due to the similarities in habitat and the overlaps in project area boundaries, it is considered likely that many of the flora species would be occur across the general area.

Of the 317 species recorded, 274 are native and 43 were introduced. Introduced species generally showed a tendency to occur in the south of the Proposed LWA7–A10 Modification Area as well as along roadsides.

Three noxious weed species were recorded in the Proposed LWA7–A10 Modification Area, being prickly pear (*Opuntia stricta*), blackberry (*Rubus fruticosus* sp. *agg*) and lantana (*Lantana camara*), however each of these was recorded in low densities.

3.1.1 Threatened Flora Species

Two confirmed threatened flora species have been recorded within the Proposed LWA7–A10 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 Proposed LWA7–A10 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 3.1**, however the actual extent of occurrence of each species is greater than this.

Although not yet confirmed (pending expert identification from the Royal Botanic Gardens), one other probable threatened species was also recorded being netted bottle-brush (*Callistemon linearifolius*). The locations of the records of this species are identified in **Figure 3.1**. Eleven individual plants for this species were recorded; however they were very closely clustered together and as such are represented by two records on this figure. Although these specimens are not yet confirmed, they have been treated as positive records for the purposes of this impact assessment. This species is listed as vulnerable under the TSC Act only.

Database searches undertaken (as documented in **Section 2.2**) identified over 900 records of heath wrinklewort (*Rutidosis heterogama*), over 250 records of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) and over 800 records of netted bottle-brush (*Callistemon linearifolius*) within a 10 kilometre radius of the centre of the Proposed LWA7–A10 Modification Area. The potential habitat for both of these species throughout the locality (particularly for heath wrinklewort (*Rutidosis heterogama*)) is considered to be widespread.

Assessments of significance for heath wrinklewort (*Rutidosis heterogama)* and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) are provided in **Appendices E** (EP&A assessment) and **F** (EPBC assessment). The assessment of significance for netted bottle brush (*Callistemon linearifolius*) is provided in **Appendix E**.

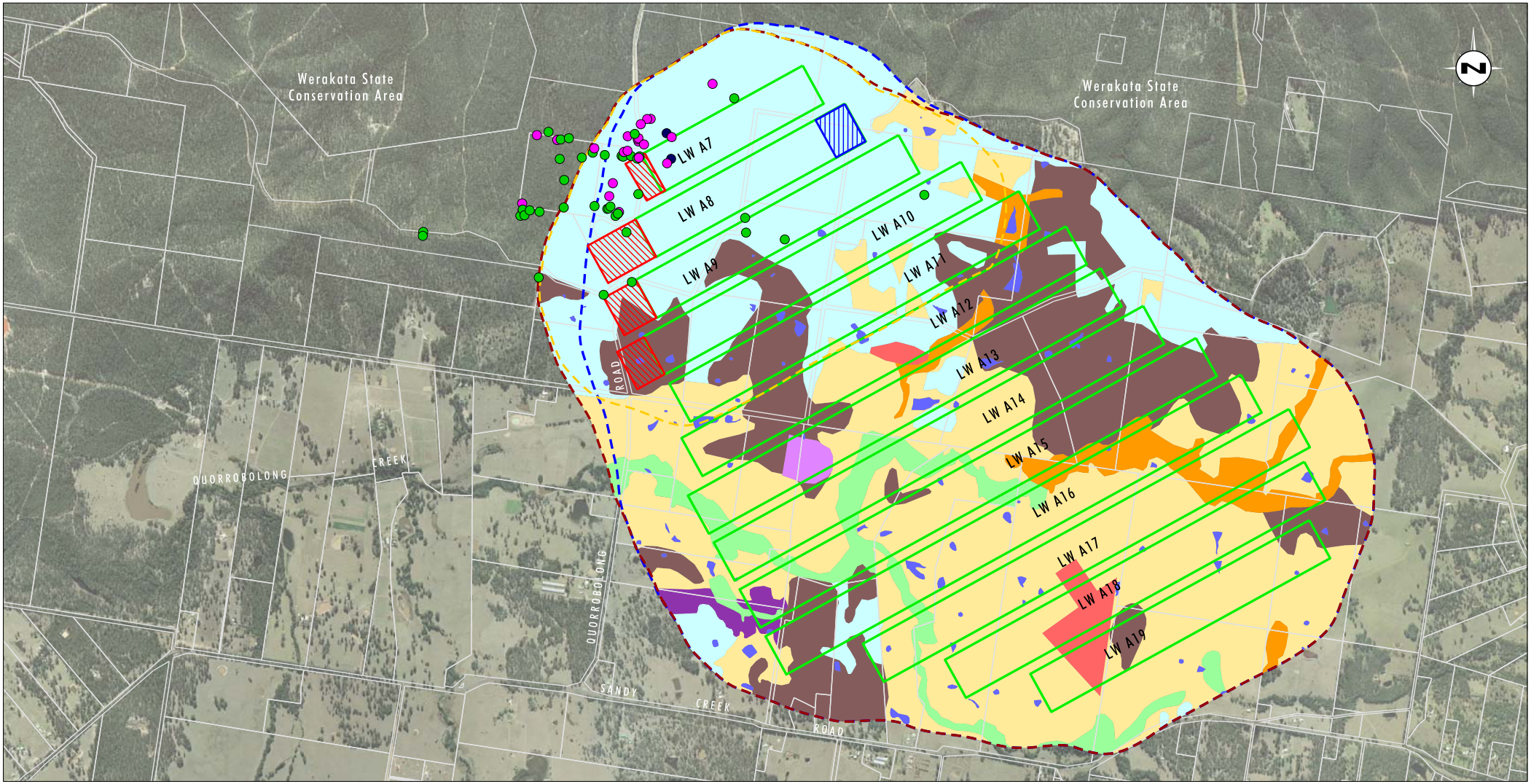

Image Source: AAM Hatch (2006)
Data Source: Austar Coal Mine (2013), LPI NSW (2009)

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Legend

- Layout for Approved Stage 3 Longwall Panels
- 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
- Proposed LW A7-A10 Modification Area
- Revised 20mm Subsidence Contour for Modified Stage 3 Longwall Layout
- Proposed Retraction of Longwall A8 Start Position
- Proposed Extension of Longwalls A7 to A10 Finish Position
- Cultivated
- Dam
- Derived Grassland / Pasture
- Derived Grassland with Scattered Canopy Trees
- Regeneration
- Riparian Red Gum Forest - EEC
- Lower Hunter Spotted Gum Ironbark Forest - EEC
- Swamp Oak Riparian Forest
- Woollybutt Open Forest Remnant
- *Rutidosis heterogama*
- *Grevillea parviflora* subsp. *parviflora*
- *Callistemon* prob. *linearifolius*

FIGURE 3.1

Vegetation Communities and Threatened Species Records

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3.1.1.1 Regionally Significant Flora Species

Briggs and Leigh (1996) list species in Australia regarded to be a 'Rare or Threatened Australian Plant' (ROTAP). In addition to the threatened species known to occur in the Proposed LWA7–A10 Modification Area, one ROTAP species was recorded being *Grevillea Montana*. One individual of this species was identified in the Proposed LWA7–A10 Modification Area.

Two other ROTAP species are known to occur within the broader Stage 3 mine area being *Macrozamia flexuosa* and *Eucalyptus fergusonii* subsp. *fergusonii.* Both *Grevillea montana* and *Macrozamia flexuosa* are reported to be widespread within the Cessnock area (Bell and Driscoll 2008).

3.1.1.2 Threatened Flora Species with Potential to Occur

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

Table 3.1 lists those threatened flora species that were not recorded within the Proposed LWA7–A10 Modification Area, however were assessed to have potential to occur based on the presence of suitable habitats. However, as none of these species have been recorded, and as the Proposed LWA7–A10 Modification will not modify any habitat requirements for these species, there was not considered to be any potential for a significant impact on these species and were assessed no further.

Table 3.1 – Threatened Flora Species with Potential to Occur within the Proposed LWA7–A10 Modification Area

Species	Status	Potential to Occur	Potential to be Impacted?
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

3.2 Vegetation Communities

The Proposed LWA7-A10 Modification will result in a 1.8 per cent (or approximately 22.2 hectare) net increase in the area of subsidence affectation associated with the Stage 3 Project. **Figure 3.1** shows the change in total area impacted by subsidence and the vegetation communities within these areas. **Table 3.2** below provides an overview of the vegetation communities located within the approved and proposed Stage 3 mining area, and summarises the net change in the area of vegetation communities affected by subsidence as a result of the Proposed LWA7–A10 Modification.

Table 3.2 – Vegetation Communities of the Proposed LWA7–A10 Modification Area

Vegetation Community	Total Area within the 20mm Subsidence Contour for the Approved Stage 3 Longwall Layout (ha) (Umwelt 2011)	Total Area within the Revised 20mm Subsidence Contour for the Modified Stage 3 Longwall Layout (ha)	Net Change in Total Area Impacted by Subsidence (ha)
Riparian Red Gum Forest	48.7	48.7	-
Swamp Oak Riparian Forest	54.8	55.5	0.8
Spotted Gum – Ironbark Forest	342.2	355.4	16.7
Derived Grassland/Pasture	482.2	484.4	2.3
Derived Grassland with Scattered Canopy Trees	237.2	242.8	2.4
Woollybutt Open Forest	5.6	5.6	-
Regeneration	9.2	9.1	-
Cultivated	17.5	17.5	-
TOTAL	1197.4	1219.0	22.2

The Proposed LWA7-A10 Modification will result in a net increase in the area of vegetation impacted by subsidence of approximately 22.2 hectares.

As shown in **Table 3.2**, the change in the extent of subsidence impacts resulting for the Proposed LWA7-A10 Modification is anticipated to impact on four vegetation communities. The area of additional subsidence affectation is dominated by Lower Hunter Spotted Gum - Ironbark Forest, with small areas of Derived Grassland with Canopy Trees, Derived Grassland/Pasture and Swamp Oak Riparian Forest.

For the purposes of this impact assessment, only those communities subject to additional impact as a result of the LWA7-A10 Modification have been described below. Impacts to the other vegetation communities present within the Proposed LWA7-A10 Modification Area were previously assessed and approved under Project Approval 08_0111 and the approved impacts to the communities will not change as a result of the proposed modification.

3.2.1 Spotted Gum – Ironbark Forest EEC

A total of 16.7 hectares of Spotted Gum – Ironbark Forest will be subject to additional impact as a result of the Proposed LWA7–A10 Modification (**Figure 3.1**). This community occupies the dry slopes and crests, where the soil is relatively infertile. It intergrades with the Hunter Lowland Red Gum Forest on the lower slopes. This community is widespread within the local area, and is also the dominant community within Werakata National Park and Werakata State Conservation Area to the north of the Study Area. Localised variants occur in response to environmental variables such as aspect, topography, geology and disturbance history (including fire and forestry practices). The Spotted Gum – Ironbark Forest within the Proposed LWA7–A10 Modification Area is consistent with the TSC Act listed EEC Lower Hunter Spotted Gum – Ironbark Forest. The community is also equivalent to the Lower Hunter Spotted Gum – Ironbark Forest, Map Unit 17 (NPWS 2000). The Spotted Gum – Ironbark Forest community recorded within the Study Area is equivalent to the Lower Hunter Spotted Gum – Red Ironbark Forest (Unit 17a) described by Bell and Driscoll (2008), and with the Lower Hunter Spotted Gum Ironbark Forest (Unit 17) described by House (2003).

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

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

Spotted Gum – Ironbark Forest supports a sparse to dense ground stratum predominantly comprising native grasses, however a number of small forbs, ferns and vines also occur. The more common species recorded include threeawn speargrass (*Aristida vagans*), wiry panic (*Entolasia stricta*), kangaroo grass (*Themeda australis*), blady grass (*Imperata cylindrica* var. *major*), blue flax lily (*Dianella caerulea*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), love creeper (*Glycine tabacina*), many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*), *Lepidosperma laterale* and *Goodenia rotundifolia*. The ground stratum has a highly variable cover throughout the Proposed LWA7–A10 Modification Area, ranging from 5 to 90 per cent. This is likely to be a reflection of the different disturbance histories relating to this community.

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*), fireweed (*Senecio madagascariensis*) and cobblers pegs (*Bidens pilosa*). A few very small patches of lantana (*Lantana camara*) and blackberry (*Rubus fruticosus* sp. agg) were observed within this community in the Proposed LWA7–A10 Modification Area.

3.2.2 Derived Grassland/Pasture

A total of 2.3 hectares of Derived Grassland/Pasture will be subject to additional impact as a result of the Proposed LWA7–A10 Modification (**Figure 3.1**). 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 Proposed LWA7–A10 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*).

3.2.3 Derived Grassland with Scattered Canopy Trees

A total of 2.4 hectares of Derived Grassland with Scattered Canopy Trees will be subject to additional impact as a result of the Proposed LWA7–A10 Modification (**Figure 3.1**). The areas in which Derived Grassland with Scattered Canopy Trees 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 Proposed LWA7–A10 Modification Area, the Derived Grassland is present largely as a result of clearing for agricultural purposes, in particular cattle grazing, and most properties still currently support livestock (cattle and horses).

Scattered canopy trees occur throughout this community, typically with less than 10 per cent cover. The canopy trees present are dependent on the topographic position. Trees typically identified in these areas were grey box (*Eucalyptus moluccana*), spotted gum (*Corymbia maculata*) and broad-leaved ironbark (*Eucalyptus fibrosa*).

The ground stratum of the Derived Grassland with Scattered Canopy Trees 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 include scarlet pimpernel (*Anagallis arvensis*), fireweed (*Senecio madagascariensis*), onion weed (*Romulea rosea*) and Scotch thistle (*Onopordum acanthium*).

The floristic composition of the Derived Grassland with Scattered Canopy Trees varies strongly between the various private landholdings, which is the result of land management practices differing between landholdings. Due to the high degree of modification and general lack of diversity of the understory and the absence of a shrub layer, this vegetation, although containing canopy species that were consistent with Spotted Gum - Ironbark Forest in places, was not considered to be consistent with the Spotted Gum - Ironbark Forest EEC.

3.2.4 Swamp Oak Riparian Forest

A total of 0.8 hectare of Swamp Oak Riparian Forest will be subject to additional impact as a result of the Proposed LWA7–A10 Modification (**Figure 3.1**). This community is found in the heavily disturbed areas of Cony Creek and Sandy Creek. 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.

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 per cent 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 Proposed LWA7–A10 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.

4.0 Fauna Results

Although only 17 fauna species were recorded opportunistically during surveys undertaken during 2013, a total of 125 have been recorded throughout fauna surveys undertaken for the original Stage 3 Mining Area (Umwelt 2008) and for the Stage 3 Modification (Umwelt 2011). It is likely that the majority of these species also make use of the habitats within the Proposed LWA7–A10 Modification Area, particularly within the higher quality areas of habitat within Werakata SCA. A list of all fauna species recorded over time is provided in **Appendix D**.

4.1 Fauna Habitat

4.1.1 Open Forest Habitat

Open forest habitats occur on the drier slopes and crests in the Proposed LWA7–A10 Modification Area. The canopy in the open forest habitats is dominated by *Eucalyptus* and *Corymbia* species and may provide foraging resources for nectarivorous bird and mammal species. The open forest habitat would also provide foraging and roosting habitat for small woodland birds and micro-bats. Although the canopy trees are relatively young, there are occasional larger hollow-bearing trees and scattered small dead stags that provide some roosting/nesting habitat for hollow-dependent species. 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 and threatened regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*).

4.1.2 Derived Grassland Habitat

Much of the southern Proposed LWA7–A10 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. These areas provide foraging habitat for some micro-bats, macropods and some bird species (for example Australian magpies (*Gymnorhina tibicen*), masked lapwings (*Vanellus miles*), magpie-larks (*Grallina cyanoleuca*) and noisy miners (*Manorina melanocephala*)), however contain minimal foraging habitat for reptiles, amphibians, or smaller terrestrial or arboreal mammals.

Scattered paddock trees within this habitat type provide a roosting resource and occasional hollow-bearing trees for hollow-dependent fauna.

4.2 Threatened Fauna Species

No threatened fauna species were recorded during the 2013 surveys undertaken, however 13 threatened fauna species have been recorded in the Approved Stage 3 Project Area during past surveys (Umwelt 2008 and 2011). The locations of these records are provided in **Figure 4.1**, and below in **Table 4.1**, along with an assessment of whether they have potential to be impacted by the Proposed LWA7–A10 Modification (re-iterated in **Appendix B**). **Table 4.1** also contains the threatened species with the potential to occur based upon database searches and literature.

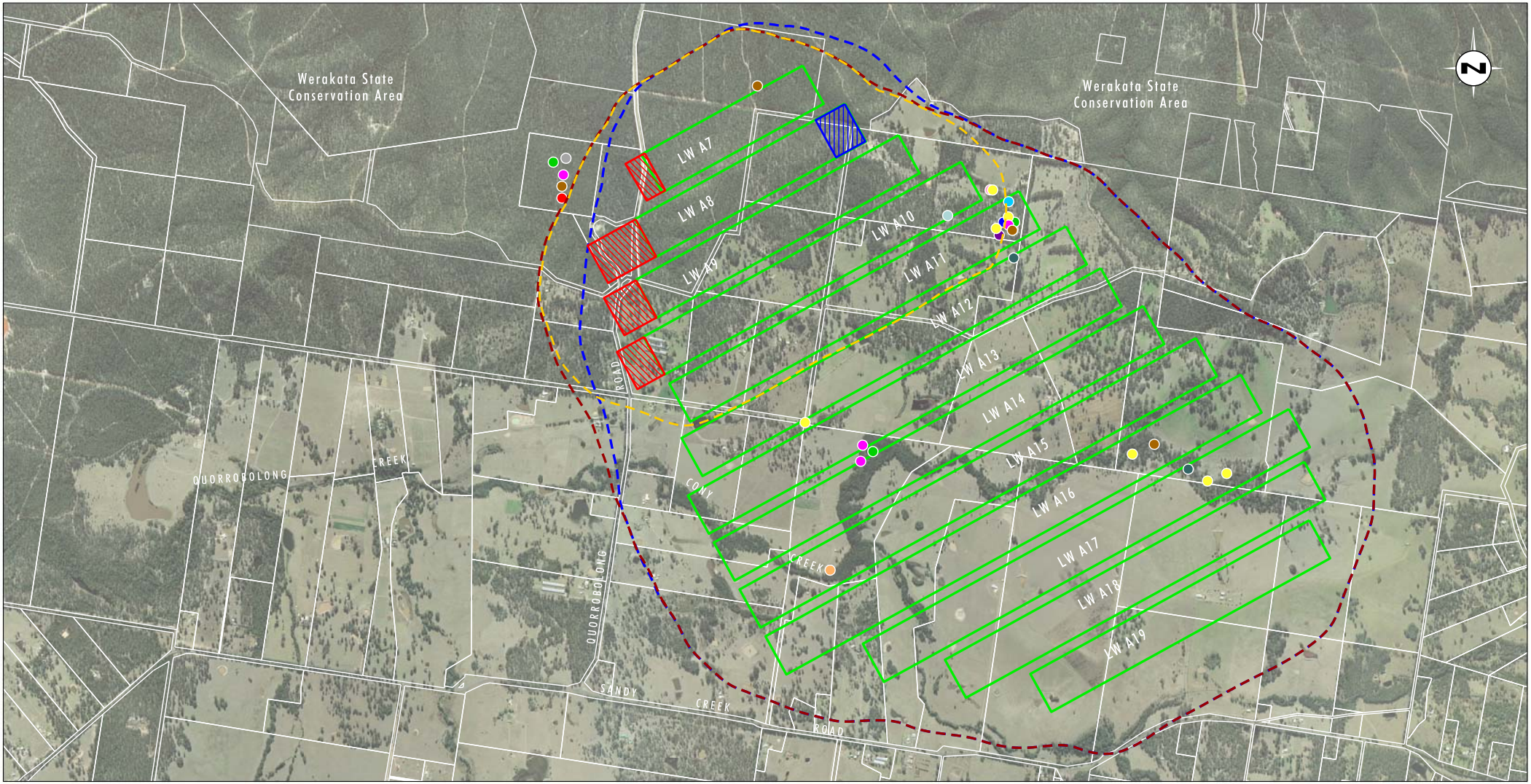

Image Source: AAM Hatch (2006)
Data Source: Austar Coal Mine (2013), LPI NSW (2009)

Legend

- Layout for Approved Stage 3 Longwall Panels
- 20mm Subsidence Contour for Approved Stage 3 Longwall Layout
- Proposed LW A7-A10 Modification Area
- Revised 20mm Subsidence Contour for Modified Stage 3 Longwall Layout
- Proposed Retraction of Longwall A8 Start Position
- Proposed Extension of Longwalls A7 to A10 Finish Position
- 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 4.1

Location of Recorded Threatened Fauna Species in the Stage 3 Mine Area

File Name (A4): R03/3264_017.dgn
20131014 10.18

Table 4.1 – Threatened and Migratory Fauna Species with Potential to Occur in the Proposed LWA7–A10 Modification Area

Species	Status	Source		Potential to be Impacted by the Proposed LWA7–A10 Modification?
		Identified During Past Surveys of Stage 3 Project Area	Identified during Database Searches	
Birds				
spotted harrier *Circus assimilis*	V (TSC)		X	No
little eagle *Hieraaetus morphnoides*	V (TSC)		X	No
square-tailed kite *Lophoictinia isura*	V (TSC)		X	No
red goshawk *Erythrotriorchis radiatus*	E (TSC) V (EPBC)		X	No
gang-gang cockatoo *Callocephalon fimbriatum*		X		No
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)		X	No
little lorikeet *Glossopsitta pusilla*		X		No
swift parrot *Lathamus discolor*	E (TSC) E (EPBC)		X	**No – Assessed in Appendices D, E and F**
regent honeyeater *Anthochaera phrygia*	CE (TSC) E (EPBC)		X	**No – Assessed in Appendices D, E and F**
turquoise parrot *Neophema pulchella*	V (TSC)		X	No
powerful owl *Ninox strenua*		X		No
barking owl *Ninox connivens*	V (TSC)		X	No
masked owl *Tyto novaehollandiae*	V (TSC)		X	No
speckled warbler *Chthonicola sagittata*	V (TSC)	X		No
scarlet robin *Petroica boodang*	V (TSC)	X		No
grey-crowned babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V (TSC)	X		No
brown treecreeper *Climacteris picumnus victoriae*	V (TSC)		X	No
black-chinned honeyeater *Melithreptus gularis gularis*	V (TSC)		X	No

Table 4.1 – Threatened and Migratory Fauna Species with Potential to Occur in the Proposed LWA7–A10 Modification Area (cont.)

Species	Status	Source		Potential to be Impacted by the Proposed LWA7–A10 Modification?
		Identified During Past Surveys of Stage 3 Project Area	Identified during Database Searches	
varied sittella Daphoenositta chrysoptera	V(TSC)		X	No
flame robin Petroica phoenicea	V(TSC)		X	No
diamond firetail *Stagonopleura guttata*	V (TSC)		X	No
hooded robin (south-eastern form) *Melanodryas cucullata cucullata*	V (TSC)		X	No
Mammals				
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC)	X		No
squirrel glider *Petaurus norfolcensis*	V (TSC)	X		No
eastern freetail-bat *Mormopterus norfolkensis*	V (TSC)	X		No
little bentwing bat *Miniopterus australis*	V (TSC)	X		No
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	X		No
southern myotis *Myotis macropus*	V (TSC)	X		No
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	X		No
large-eared pied bat *Chalinolobus dwyeri*	V (TSC)	X	X	No
greater broad-nosed bat *Scoteanax rueppellii*	V (TSC)	X	X	No
Migratory Species				
white-bellied sea eagle *Haliaeetus leucogaster*	MIG (EPBC)	X		No
satin flycatcher *Myiagra cyanoleuca*	MIG (EPBC)	X		No
rainbow bee-eater *Merops ornatus*	MIG (EPBC)	X		No

It was considered that there was appropriate habitat for each of these species within the Proposed LWA7–A10 Modification Area, particularly within the higher quality habitats of Werakata SCA. Those species not considered likely to be impacted are those which are not likely to have their specific habitat requirements impacted by the Proposed LWA7–A10 Modification. All species were considered to not have the potential to be impacted by the Proposed LWA7–A10 Modification. In relation to the Commonwealth listed swift parrot (*Lathamus discolour*) and regent honeyeater (*Anthochaera Phrygia*), a precautionary approach was undertaken with a full assessment of significance completed for these species(refer to **Appendix D** to **F)**, with results summarised in **Section 6.0**.

4.3 SEPP 44 (Koala Habitat Assessment Results)

One SEPP 44 tree species was identified within the Proposed LWA7–A10 Modification Area, being grey gum (*Eucalyptus punctata*) and one additional SEPP 44 species is known to occur in the wider Stage 3 mining area, being forest red gum (*Eucalyptus tereticornis*). There is potential that these trees could provide a foraging resource for koala species, however as they generally occur in low densities throughout the Stage 3 Mining Area, it was not considered that these areas would provide core forging habitat for his species.

No koalas were opportunistically identified in the Proposed LWA7–A10 Modification Area during 2013 surveys, or during surveys undertaken for Umwelt 2008 or 2011. As such, the Proposed LWA7–A10 Modification Area is not regarded to be core koala habitat. Therefore no further consideration of SEPP 44 is required for this project.

5.0 Aquatic Results

5.1 Aquatic Species and Habitat

There are some small farm dams scattered throughout the southern Proposed LWA7–A10 Modification Area, however these had very little edging vegetation and their primary use was for stock watering. It was considered that these areas provided little value for native fauna species.

A small number of unnamed ephemeral tributaries were additionally identified during the field surveys. The vegetation in these areas tended to have greater densities of paperbark (*Melaleuca* spp.) and sedge species, however vegetation was not substantially different from that of surrounding vegetation. No permanent areas of aquatic habitat were identified along these tributaries.

5.2 Groundwater Dependent Ecosystems

There were no groundwater dependent ecosystems identified in the Proposed LWA7–A10 Modification Area.

6.0 Impact Assessment

Threatened and migratory species, endangered populations, and TECs listed under the TSC Act and/or EPBC Act recorded or with potential to occur within 10 kilometres of the Proposed LWA7–A10 Modification Area have been collated from the searches of the OEH Atlas of NSW Wildlife Database and DSEWPC Protected Matters Database as well as the results of the review of relevant literature and the results of the field survey. The likelihood of occurrence of each threatened species, migratory species, endangered population and TEC has been assessed via a likelihood of occurrence and impact assessment undertaken in **Appendix B**.

The likelihood of occurrence assessment considered the suitability of habitat types present in the Proposed LWA7–A10 Modification Area, the nature of the proposed disturbance, the availability of surrounding suitable habitat types, and for fauna species their ability to move throughout the landscape. For those identified as potentially occurring in the Proposed LWA7–A10 Modification Area, the likelihood of impact assessment considered the extent and importance of habitat features to be impacted, the extent of potentially suitable habitat features adjacent to the Proposed LWA7–A10 Modification Area and in the surrounding locality, the potential for the Project to fragment or isolate areas of potentially suitable habitat, and for fauna species, their mobility within the landscape.

Where the likelihood of occurrence and impact assessment identified a threatened species, migratory species, endangered population, or TEC as occurring/potentially occurring and/or potentially being impacted, Seven Part Tests have been undertaken for those listed under the TSC Act (**Appendix E**) and Significance Assessments have been undertaken for those listed under the EPBC Act (**Appendix F**).

6.1 General 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 2005). Subsidence relating to longwall mining may result in secondary impacts, which typically impact greatest on riparian ecosystems. Broadly, potential changes to riparian environments that could 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).

An assessment of the potential ecological impacts of the Stage 3 Project (Umwelt 2011) concluded that due to the depth of cover of the coal seam (455 to 750 m) and the topography and geology of the area, subsidence impacts were not expected to have a significant impact on the ecology or ecological communities of the Stage 3 mining area. Nor were they

expected to have a significant impact on runoff regimes, bank stability, channel alignment, in-channel and out of channel ponding or groundwater availability.

The Proposed LWA7–A10 Modification is predicted to result in similar maximum subsidence, tilt and curvature to that approved under Project Approval 08_0111 (MSEC 2013). As a result, the predicted impacts on flooding and drainage are similar to those documented for the approved Stage 3 Project (Umwelt 2008 and Umwelt 2011). Consequently, subsidence impacts are not expected to have a significant impact on the ecological features of the Proposed LWA7–A10 Modification Area.

As the predicted subsidence impacts on landform and secondary impacts on flooding and drainage are not expected to have a significant impact on the ecology of the area, the increase in the subsidence affectation area of 1.8 per cent or 22 hectares associated with the Proposed LWA7–A10 Modification is not expected to significantly change the existing approved ecological impacts of the Stage 3 Project.

6.2 Threatened Species, Endangered Populations and Threatened Ecological Communities Assessed under the NSW EP&A Act

Two confirmed vulnerable flora species, one probable vulnerable flora species and one EEC listed under the TSC Act were identified in the Proposed LWA7–A10 Modification Area, these being the heath wrinklewort (*Rutidosis heterogama*), small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), *Callistemon* prob. *linearifolius* and Lower Hunter Spotted Gum – Ironbark Forest respectively. No other threatened flora species or TECs were identified in the Proposed LWA7–A10 Modification Area. There are two threatened fauna species, these being the swift parrot (*Lathamus discolor*) and the regent honeyeater (*Anthochaera phrygia*), that as a result of their level of threat and sensitivity to environmental change, have been subject to a Seven Part Test (refer to **Appendix E**). The swift parrot (*Lathamus discolor*) is listed as endangered under the TSC Act and the regent honeyeater (*Anthochaera phrygia*) is listed as critically endangered under the TSC Act.

A Seven Part Test under the EP&A Act was undertaken for these five threatened species and one EEC (refer to **Appendix E**). The outcomes from the Seven Part Tests for the threatened species were based upon the likely minimal environmental change as a result of the Proposed LWA7–A10 Modification, as it is predicted that no vegetation clearing will be required and the subsidence that is likely to occur is predicted to be relatively minor and even across the surface of the Proposed LWA7–A10 Modification Area.

As such it is not anticipated that the Proposed LWA7–A10 Modification will result in a significant impact on surface vegetation (including threatened species or EECs) or the habitats of any threatened fauna species.

6.2.1 Groundwater Dependent Ecosystems

As no groundwater dependent ecosystems occur in the Proposed LWA7–A10 Modification Area, there will be no impacts from the Proposed LWA7–A10 Modification on any groundwater dependent ecosystems.

6.3 Matters of National Environmental Significance Assessed under the Commonwealth EPBC Act

Under the Commonwealth EPBC Act, the approval of the Commonwealth Minister for the Environment is required for any action that may have a significant impact on matters of national environmental significance (MNES). These matters are:

- World Heritage properties;
- National Heritage places;
- wetlands of international importance;
- listed threatened species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions; and
- a water resource, in relation to coal seam gas development and large coal mining development.

The Proposed LWA7–A10 Modification will not result in impacts on World Heritage properties, National Heritage places, wetlands of international importance, migratory species, Commonwealth marine areas or the Great Barrier Reef Marine Park and will not involve any nuclear actions or actions relating to a water resource.

However it was identified that the Proposed LWA7–A10 Modification had potential to impact two vulnerable flora species (listed under the EPBC Act) being heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) both of which were identified in the Proposed LWA7–A10 Modification Area. As noted in **Section 6.2**, the swift parrot (*Lathamus discolor*) and the regent honeyeater (*Anthochaera phrygia*), as a result of their level of threat and sensitivity to environmental change, have been subject to an Assessment of Significance (refer to **Appendix F**). The Proposed LWA7–A10 Modification also has the potential to impact on the swift parrot (*Lathamus discolor*) and regent honeyeater (*Anthochaera phrygia*) which are both listed as endangered under the EPBC Act, with the regent honeyeater (*Anthochaera phrygia*) additionally listed as a migratory species.

An Assessment of Significance under the EPBC Act was undertaken for these four species (refer to **Appendix F**). The outcomes of the Assessments of Significance for these species indicated that, as the Proposed LWA7–A10 Modification does not require the clearing of vegetation and was unlikely to disrupt the condition of surface vegetation present, it was unlikely that a significant impact on MNES would occur as a result of the Proposed LWA7–A10 Modification.

6.4 Threatened Species, Endangered Populations and TECs Assessed Under the NSW FM Act 1994

No threatened species, endangered populations or TECs listed on the *Fisheries Management Act 1994* (FM Act) were identified during the likelihood of occurrence assessment undertaken in **Appendix B**. The Proposed LWA7–A10 Modification is unlikely to result in a significant impact on any threatened species, endangered populations or TECs listed on the FM Act.

7.0 Management Recommendations

Austar manages flora and fauna within the Stage 3 mining area is accordance with the approved Austar Biodiversity Management Plan (BMP) (Umwelt 2013). No additional ecological impact mitigation measures are considered necessary for the Proposed LWA7–A10 Modification, as the subsidence predictions indicate no likely impact to ecological features. An ecological monitoring program as identified within the BMP (Umwelt 2013) is currently in place for the Stage 3 Mining Area, and this program includes existing vegetation and photo monitoring plots that fall within the Proposed LWA7–A10 Modification Area. Continuation of monitoring at these plots (as per the requirements of the BMP) will be used to identify any potential changes to ecological values as a result of mining of the Proposed LWA7–A10 Modification Area.

This monitoring program has been specifically designed to include targeted monitoring of the threatened species heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*), as well as Lower Hunter Spotted Gum - Ironbark Forest EEC and habitat features (specifically those for threatened species).

If identification by the Royal Botanic Gardens confirms the presence of threatened flora species netted bottle-brush (*Callistemon linarifolius*), the BMP will be revised to reflect any additional monitoring requirements for this species.

Provided that subsidence impacts from the Proposed LWA7–A10 Modification are consistent with those predicted, no additional mitigation measures are deemed to be necessary.

8.0 Conclusion

An analysis of the predicted subsidence impacts and associated hydrological changes as a result of the modifications to longwall panels LW A7, LW A8, LW A9 and LW A10 in the Stage 3 Mining Area have identified that the surface impacts on the existing ecological values of the Proposed LWA7–A10 Modification Area are likely to be negligible.

Seven Part Tests under the EP&A Act and Significance Assessments under the EPBC Act were undertaken and concluded that the Proposed LWA7–A10 Modification would be unlikely to result in a significant impact on any of these species or TECs. The proposed construction of the Project is unlikely to have a significant impact on any threatened species, endangered populations or TECs listed on the TSC Act or EPBC Act.

As ecological impacts are assessed as likely to be negligible or unlikely to result in a significant impact, the management measures in the approved Biodiversity Management Plan remain appropriate to manage subsidence impacts within the Proposed LWA7–A10 Modification Area. The Biodiversity Management Plan will be updated to reflect the Proposed LWA7-A10 Modification Area, and will include additional targeted monitoring of netted bottle-brush (*Callistemon linarifolius*), if it's presence is confirmed.

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APPENDIX A

Literature Review

Appendix A – Literature Review

1. Austar Ecological Assessment, Stage 3 mine Area (Longwalls 6 to 17) and Surface Infrastructure Site (Umwelt 2008)

This Ecological Assessment was undertaken for the extension of longwall mining operations at Austar Coal Mine to include an additional 12 longwall panels and for the development of its associated surface infrastructure site. Detailed ecological surveys were undertaken by Umwelt to identify the impacts of the proposed developments on any ecological values and to integrate appropriate measures to avoid or minimise impacts.

1.1. Flora Surveys

Table 1.1 below provides a summary of the flora surveys that were undertaken for the project.

Table 1.1 – Flora Survey Dates

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

Surveys included systematic plot based surveys, targeted threatened species surveys, meander transects and roadside assessment points.

1.1.1. Systematic Plot-based Surveys

Plot-based survey sites were positioned at sites that were selected by considering a range of attributes that influence or determine the type of vegetation communities present, in particular topographic position (**Schematic 1.1**), slope, aspect and soil type. The selection of plot locations also aimed to achieve effective coverage, in particular areas in which the vegetation was thought to have potential to support EECs or any other vegetation type.

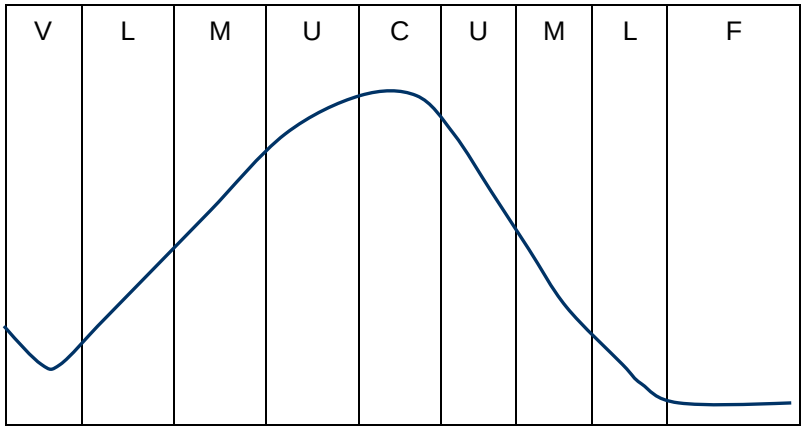

Diagram of simplified cross section of land showing:

- **crest (C)**
- **upper slope (U)**
- **mid slope (M)**
- **lower slope (L)**
- **valley (V)**
- **flat (F)**

Schematic 1.1 – Illustration of topographic positions sampled

The methodology undertaken for these plot-based surveys were the same as described in **Section 2.3.2** of the main text.

1.1.2. Transect Surveys

Transect surveys were undertaken in the same manner as those undertaken for 2013 Meander Transects (see **Section 2.3.1** of the main report). These transect surveys were divided between targeted transects and meander transects (see **Figure 2.1** of the main report).

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

The objectives of meander transects were to:

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

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

1.1.3. Roadside Assessment Points

A number of remnants of vegetation were not able to be surveyed due to restricted access to private landholdings. As such, a series of roadside assessment points were surveyed to identify broadly the vegetation communities that may be present in the inaccessible areas.

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

1.2. Fauna Surveys

Fauna surveys were undertaken during winter and spring and included Elliot trapping, hair funnels and tubes, Anabat echolocation, harp trapping, cage trapping, spotlighting, reptile,

amphibian and bird searches, call playback surveys, habitat assessment, SEPP 44 Assessment, opportunistic records and searches for signs of presence.

1.2.1. Winter Fauna Trapping

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

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

The hair tubes were left in-situ for 14 days at each site. Terrestrial traps were not incorporated into the winter survey due to the risk of frost and therefore stress to any trapped animal.

1.2.2. Spring Fauna Trapping

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

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

1.2.3. Spotlighting Surveys

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

1.2.4. Reptile and Amphibian Surveys

Two diurnal and two nocturnal herpetological surveys, each of one person hour, were conducted in likely habitat areas at each of the seven survey sites on two separate days.

Two additional nocturnal amphibian and reptile searches were undertaken on a separate night.

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

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

1.2.5. Diurnal Bird Surveys

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

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

1.2.6. Call Playback Surveys

At each of the survey sites the recorded calls of the powerful owl (*Ninox strenua*), masked owl (*Tyto novaehollandiae*), barking owl (*Ninox connivens*), squirrel glider (*Petaurus norfolcensis*), and koala (*Phascolarctos cinereus*) were played. Each call was played for a minimum of 4 minutes followed by a listening period of 2 minutes before the beginning of the next species call. Calls were broadcast using a 10 watt directional loud hailer. Mammal calls were played before bird calls to prevent the calls of predators (large owls) decreasing the likelihood of prey species (gliders) responding to call playback.

1.2.7. Habitat Assessment

Habitat assessments were undertaken at numerous locations throughout the Original Stage 3 Mine Area. Locations for the habitat assessments were selected intuitively, choosing a range of sites which supported obviously different habitats. The assessment targeted the identification of potential habitat and resources for threatened fauna species. Observations of the following habitat features were made throughout the Original Stage 3 Mine Area:

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

In addition to these general habitat features, searches for specific habitat requirements of threatened fauna species considered to potentially occur within the locality were also made,

including the presence of winter-flowering eucalypt species, which are important foraging resources for migratory species such as the regent honeyeater (*Anthochaera phrygia*) and the swift parrot (*Lathamus discolor*).

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

All habitat features observed were considered when assessing the likely presence or absence of any threatened fauna species within the Original Stage 3 Mine area. The known habitat requirements of each potentially occurring threatened species were compared with the habitat features recorded within the original Stage 3 Mine Area.

All fauna species observed opportunistically during field surveys were recorded.

1.3. Aquatic Surveys

Aquatic surveys and assessment were also undertaken on 26 September 2007 and 18 December 2007.

1.4. Project Outcomes

Field surveys identified a total of 313 flora species (272 of which were native and 41 were introduced) Two threatened flora species were identified being the heath wrinklewort (*Rutidosis heterogama*) and small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

Eight vegetation communities were identified including four EECS, being:

- Lower Hunter Spotted Gum Ironbark Forest;
- River-flat Eucalypt Forest;
- Hunter Lowland Red Gum Forest; and
- Quorrobolong Scribbly Gum Woodland.

Field surveys identified a total of 56 fauna species in the proposed Surface Infrastructure Site and 97 fauna species within the proposed Stage 3 Mine Area. Threatened fauna species recorded were the:

- Gang-gang cockatoo (*Callocephalon fimbriatum*);
- Grey-crowned babbler (*Pomatostomus temporalis temporalis*);
- Speckled warbler (*Chthonicola sagittata*);
- Powerful owl (*Ninox strenua*);
- Squirrel glider (*Petaurus norfolcensis*);
- Little bentwing-bat (*Miniopterus australis*);
- Eastern bentwing bat (*Miniopterus schreibersii oceanensis*);
- Southern myotis (*Myotis adversus*); and
- Eastern freetail-bat (*Mormopterus norfolkensis*).

The little lorikeet (*Glossopsitta pusilla*) and scarlet robin (*Petroica boodang*) were also recorded, however were not listed as threatened at the time of the surveys.

Three migratory species listed under the EPBC Act were additionally recorded, being the white-bellied sea-eagle (*Haliaeetus leucogaster*), satin flycatcher (*Myiagra cyanoleuca*) and rainbow bee-eater (*Merops ornatus*).

Impact assessments undertaken for the project indicated that there was not likely to be a significant impact as a result of the proposed longwall mining or Surface Infrastructure Site. Mitigation measures for the Project included the provision of an offset site and a detailed clearance procedure for habitat trees.

2. Ecological Assessment for Austar Proposed Stage 3 Modifications (Umwelt 2011)

This Ecological Assessment was prepared for a proposed modification to the approved Stage 3 mine plan (summary provided above from Umwelt 2008). This modification was for the proposed re-orientation of the Stage 3 longwall panels. No proposed changes were made to the underground mining method, total approved rate, quantity of extraction or the associated infrastructure.

Given that the footprints of the original and the proposed Stage 3 Longwall panel alignment were largely overlapped, this Ecological Assessment drew on the outcomes of the extensive surveys that were undertaken for the original impact assessment. However, supplementary ecological surveys were undertaken in new areas to be impacted.

Supplementary flora and fauna surveys were undertaken in areas not originally proposed for disturbance, these included two vegetation plots, five transects, and opportunistic fauna observations during the two days of flora surveys.

Only one new flora species was identified during the 2010 surveys that was not identified during the 2008 Ecological Assessment.

This Ecological Assessment identified seven vegetation communities in the Stage 3 modification area, being:

- Riparian Red Gum Forest;
- Swamp Oak Riparian Forest;
- Lower Hunter Spotted Gum Ironbark Forest;
- Derived Grassland/pasture;
- Derived Grassland with Scattered Canopy trees;
- Woollybutt Open Forest; and
- Regeneration and Cultivated Areas.

Of these seven communities, two were consistent with TECs, being River-flat Eucalypt Forest and Lower Hunter Spotted Gum – Ironbark Forest.

As identified during Umwelt (2008), only two threatened flora species were identified, being heath wrinklewort (*Rutidosis heterogama*) and small flower grevillea (*Grevillea parviflora* subsp. *parviflora*).

Threatened fauna species identified in the proposed modification area were the:

- Little bentwing bat (*Miniopterus australis*);
- Eastern freetail bat (*Mormopterus norfolkensis*);
- Southern myotis (*Myotis macropus*);
- Eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- Gang-gang cockatoo (*Callocephalon fimbriatum*);
- Squirrel glider (*Petaurus norfolcensis*);
- Eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- Grey-crowned babbler (*Pomatostomus temporalis temporalis*);
- Speckled warbler (*Chthonicola sagittata*);
- Powerful owl (*Ninox strenua*);
- Grey-headed flying fox (*Pteropus poliocephalus*);
- Little lorikeet (*Glossopsitta pusilla*); and
- Scarlet robin (*Petroica boodang*).

This Ecological Assessment concluded that it was not likely that there would be any significant impacts as a result of the Proposed Modifications.

3. 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 and approximately 5 kilometres to the south-west of the LWA7–A10 Modification Area. The proposal was for underground longwall mining and associated surface infrastructure.

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

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

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

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

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

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

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

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

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

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

A flora survey and vegetation mapping of Werakata National Park (near Cessnock, NSW) was undertaken by Bell (2004) on behalf of the National Parks and Wildlife Service (NPWS, now 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 corresponds 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.

6. Vertebrate Fauna of Werakata National Park (DEC 2005)

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

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

- Stephens banded snake (*Hoplocephalus bungaroides*);
- black bittern (*Ixobrychus flavicollis*);
- glossy black-cockatoo (*Calyptorhynchus lathami*);
- swift parrot (*Lathamus discolor*);
- turquoise parrot (*Neophema pulchella*);
- barking owl (*Ninox connivens*);
- powerful owl (*Ninox strenua*);
- masked owl (*Tyto novaehollandiae*);
- brown treecreeper (eastern subsp.) (*Climacteris picumnus victoriae*);
- specked warbler (*Chthonicola sagittata*);
- black-chinned honeyeater (eastern subsp.) (*Melithreptus gularis gularis*);
- regent honeyeater (*Anthochaera phrygia*);
- hooded robin (*Melanodryas cucullata*);
- grey-crowned babbler (eastern subsp.) (*Pomatostomus temporalis temporalis*);
- koala (*Phascolarctos cinereus*);
- yellow-bellied glider (*Petaurus australis*);
- squirrel glider (*Petaurus norfolcensis*);

- grey-headed flying-fox (*Pteropus poliocephalus*);
- eastern freetail-bat (*Mormopterus norfolcensis*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- little bentwing-bat (*Miniopterus australis*); and
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

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

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

Several recovery plan actions were outlined in the document, primarily focusing on the protection of the swift parrot (*Lathamus discolor*), regent honeyeater (*Anthochaera 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.

7. Vegetation of the Cessnock-Kurri Kurri Region, Cessnock LGA, New South Wales: Surveys, Classification and mapping (Bell and Driscoll 2008)

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

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

Within the project area covered by Bell and Driscoll (2008) close to 800 native plant taxa and 37 vegetation communities were recorded, including 10 threatened flora species and three undiscovered or previously undescribed flora taxa. Seven EECs were found to be present within the Study Area. Between one and six vegetation community variants were described for each of these EECs.

APPENDIX B

Threatened and Migratory Species,
Endangered Populations and
Threatened Ecological Communities with
Potential to Occur

Appendix B – Threatened and Migratory Species, Endangered Populations and Threatened Ecological Communities with Potential to Occur

Threatened and migratory species, endangered populations (EPs) and threatened ecological communities (TECs) listed under the *Threatened Species Conservation Act 1995* (TSC Act) and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) recorded or considered likely to occur within 10 kilometres of the LWA7–A10 Modification Area have been identified based on the results of database searches as well as the results of the literature review described in the Ecological Assessment.

Table 1 below identifies the threatened flora species, endangered populations and TECs with the potential to occur in the LWA7–A10 Modification Area. **Table 2** identifies the threatened and migratory fauna species that are considered to have potential to occur within the LWA7–A10 Modification Area.

These tables contain information on habitat requirements, known range and reservation within conservation reserves in the region, as well as an assessment as to whether the entity is likely to occur in the LWA7–A10 Modification Area and whether there is the potential for the entity to be impacted by the Project. This information was obtained from searches undertaken of the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife (2013) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) Protected Matters Database (2013) and literature reviews undertaken by Umwelt.

An assessment of significance was prepared in accordance with the requirements of the TSC and EPBC Acts for each threatened and migratory species, EP or TEC recorded or for which there is the potential for impact as a result of the Project. These assessments of significance are provided in **Appendices D** and **E**.

Table 1 – Threatened Flora Species, Endangered Populations and Threatened Ecological Communities Recorded or with Potential to Occur in the LWA7–A10 Modification Area

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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 potential for this species to occur in the Spotted Gum – Ironabrk habitats of the LWA7–A10 Modification Area. The LWA7-A10 Modification will not modify any habitat requirements of this species, consequently there is no potential for a significant impact on potential habitat for this species.	No
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	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	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		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.	populations have been identified at Karuah.		It is not likely that there will be a significant impact on this species.	
netted 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	A probable record of this species has been recorded within the LWA7–A10 Modification Area. There is potential for a significant impact on this species.	Yes
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*),	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.	There is potential for this species to occur in the Spotted Gum – Ironabrk habitats of the LWA7–A10 Modification Area. The LWA7-A10 Modification will not modify any	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		brown stringybark (*E. capitellata*) and red bloodwood (*Corymbia gummifera*).			habitat requirements of this species, consequently there is no potential for a significant impact on potential habitat for this species.	
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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Craven grey box *Eucalyptus largeana*	E (TSC) 3R (ROTAP)	Found in wet forest on subcoastal ranges.	Confined to the Gloucester-Craven district near Pokolbin, although a number of unsubstantiated records exist from outside the currently accepted range.	This species is not known from any conservation reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
Pokolbin mallee *Eucalyptus pumila*	V (TSC) V (EPBC) 2VCi (ROTAP)	The single known population occupies north-west-facing slopes derived from sandstone.	Currently known only from a few small populations west of Pokolbin in the Hunter Valley. Historical records also exist for Wyong and Sandy Hollow, however, has not been recorded recently in these areas.	Pokolbin SF	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					significant impact on this species.	
Euphrasia arguta	CE (TSC) X (EPBC) 3X (ROTAP)	This species grows in grassy areas near rivers (BioNet 2013).	This species is presumed to be extinct. When present, it was recorded from as far south as Bathurst and as far north as Walcha. It was believed to occur in the botanical subdivisions of the North Coast, Northern Tablelands, Central Tablelands, North Western Slopes and Central Western Slopes (BioNet 2013).	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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 has been recorded within the LWA7–A10 Modification Area. There is potential for a significant impact on this species	Yes
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 southeast Queensland.	Corrabare SF Yengo NP Werakata SCA	There is a potential for this species to occur in the Spotted Gum – Ironabrk habitats of the LWA7–A10 Modification Area.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					The LWA7-A10 Modification will not modify any habitat requirements of this species, consequently there is no potential for a significant impact on potential habitat for this species.	
Omeos storkbill *Pelargonium* sp. *striatellum*	E (TSC) E (EPBC)	Occurs in a narrow habitat typically just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	Known from only three locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. The only other known location is at Lake Omeo in Victoria.	This species is not known from any conservation reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	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	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		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.	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.		there will be a significant impact on this species.	
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 1.5km²	This species is not known from any conservation reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					significant impact on this species.	
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.	There is a potential for this species to occur in the Spotted Gum – Ironabrk habitats of the LWA7–A10 Modification Area. The LWA7-A10 Modification will not modify any habitat requirements of this species, consequently there is no potential for a significant impact on potential habitat for this species.	No
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	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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed.			on this species.	
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 has been recorded within the LWA7–A10 Modification Area. There is potential for a significant impact on this species.	Yes
Siahs backbone *Streblus pendulinus*	E (EPBC)	This species occurs in warmer rainforest, mostly along watercourses, north from Milton. Listing advice for this species indicates that the species is endangered on Norfolk Island and taxonomic revisions may have unintentionally included mainland occurrences of the species. For the purposes of this assessment it is assumed that the listing relates only to the Norfolk Island population of the species.	There are a number of known records of this species occurring in the Muswellbrook and Singleton areas. The closest records occur approximately 15 kilometres north-east of the LWA7–A10 Modification Area.	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
Tetratheca glandulosa	2VC- (ROTAP)	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridge-tops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam.	Restricted to the following LGAs: Baulkham Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong. There are approximately 150 populations of this plant ranging from Sampsons Pass (Yengo NP) in the north to West Pymble (Lane Cove NP) in the south. The eastern limit is at Ingleside (Pittwater LGA) and the western limit is at East Kurrajong (Wollemi NP).	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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 has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
Zannichellia palustris	E (TSC) 3R+ (ROTAP)	Grows in fresh or slightly saline stationary or slowly flowing water.	Known to occur in the Hunter, Karuah Manning and Wyong sub-regions of the Hunter/Central Rivers Catchment.	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					considered unlikely to occur. It is not likely that there will be a significant impact on this species.	
ENDANGERED FLORA POPULATIONS						
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.	This population has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this 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,	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.	This population has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		typically between two and six metres above the ground.			It is not likely that there will be a significant impact on this population.	
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 pple (*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.	This population has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this 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.	This population has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this population.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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 3,500 ha in the lower Hunter – Central Hunter region (in 1990s); less than 2,700 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 community has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this community.	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	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 community has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		remaining fragments. Consequently at heavily disturbed sites only some of the species which characterise the community may be present.			on this community.	
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 kilometres by 35 kilometres centred on the Cessnock – Beresfield area.	Corrabare SF Pokolbin SF Werakata NP	This community occurs within the LWA7–A10 Modification Area and has the potential to be impacted by the Project.	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.	This community has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this community.	No
River– flat Eucalypt Forest on Coastal Floodplains	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	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	This EEC is not known from any conservation reserves in the region.	This community has not been recorded within the LWA7–A10 Modification Area and is considered	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally occurs below 50 metres elevation, but may occur on localised river flats up to 250 metres 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*).	no further west than Canberra.		unlikely to occur. It is not likely that there will be a significant impact on this community.	
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)	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,	Hunter Estuary NP	This community has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this community.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		elevation.	Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven but may occur elsewhere in these bioregions.			
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 metres (though sometimes up to 50 metres) 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 community has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this community.	No

Notes:

2	found over < 100 km
3	found over > 100 km
a	adequately reserved
C	in a conservation reserve
-	species recorded from a reserve but population size unknown
CE	Critically endangered
CEEC	Critically endangered ecological community
E	Endangered
EEC	Endangered ecological community
EP	Endangered population
EPBC	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
i	inadequately reserved
K	poorly known
LCA:	Landscape Conservation Area
NP	National Park
TSC:	NSW *Threatened Species Conservation Act 1995*
V	Vulnerable
R	Rar
ROTAP	Rare or Threatened Australian Plant
SCA	State Conservation Area
SF	State Forest

Table 2 – Threatened Fauna Species, Threatened Fauna Populations and Migratory Species Known or Predicted to Occur in the LWA7–A10 Modification Area

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
giant barred frog *Mixophyes iteratus*	E (TSC)	This species forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest,	Coast and ranges from south-eastern Queensland to the Hawkesbury River in NSW. North-eastern NSW, particularly the Coffs Harbour-Dorrigo area,	Watagans NP	This species has not been recorded within the LWA7–A10 Modification Area and is	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		at elevations below 1000 m. They breed around shallow, flowing rocky streams.	is now a stronghold.		considered unlikely to occur. It is not likely that there will be a significant impact on this species.	
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.	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
Australasian bittern *Botaurus poiciloptilus*	E (TSC)	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.).	This species may be found over most of the state except for the far north-west.	Hunter Estuary NP	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
Easten bristlebird *Dasyornis brachypterus*	E (TSC) E (EPBC)	The eastern bristlebird can be found in dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW it occurs in open forest with tussocky grass understorey.	The eastern bristlebird is known to occur in three disjunct areas of south-eastern Australia, in southern Queensland/north NSW, the Illawarra region and the NSW/Victoria border.		This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					there will be a significant impact on this species.	
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		conditions are favourable. The nests are usually located in dense vegetation at or near water level.				
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
spotted harrier *Circus assimilis*	V (TSC)	Their habitat of choice is open grassy woodland, grassland, inland riparian woodland and shrub steppe. Although mostly associated with native grasslands it has also been identified in agricultural farmland. Their nest is made in a tree and composed of sticks.	The spotted harrier can be found throughout mainland Australia except for areas of dense forest on the coast, escarpments and ranges and rarely ever in Tasmania.	This species is not known to occur in any reserves in the region.	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					potential habitat for this species.	
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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

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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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an 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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					potential habitat for this species.	
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	Although this species has not been recorded it has the potential to occur.	Although the LWA7-A10 Modification is not considered to have potential to significantly impact this species, a precautionary approach has been undertaken with a full assessment of significance carried out.
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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					potential for an impact on potential habitat for this 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	Although this species has not been recorded it has the potential to occur.	Although the LWA7-A10 Modification is not considered to have potential to significantly impact this species, a precautionary approach has been undertaken with a full assessment of significance carried out.
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.	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
					Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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 LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		tree hollows.			unlikely to occur. There is unlikely to be potential for a significant impact on this species.	
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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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,	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	Werakata NP	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	Detailed Assessment of Significance Required?
		stringybarks, ironbarks and tea-trees.	Richmond River district. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions.		Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for 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	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	Corrabare SF Olney SF Pokolbin SF Werakata NP Werakata SCA	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species.	No

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		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.	is basically continuous from the coast to the far west.	Yengo NP	However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
hooded robin (south-eastern form) *Melanodryas cucullata*	V (TSC)	This species occupies a range of eucalypt woodlands, acacia shrublands and open	This form of the hooded robin is distributed throughout south-eastern Australia, from central Queensland to the Spencer	Werakata NP	The LWA7–A10 Modification Area supports potential foraging and	No

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cucullata		forests. In temperate woodlands it favours open areas adjoining large woodland blocks, with areas of dead timber and sparse shrub cover. In semi-arid western NSW, the hooded Robin favours open woodlands of belah (*Casuarina cristata*), mulga (*acacia aneura*) and cypress (*Callitris* spp.).	Gulf, South Australia. This form occurs throughout NSW except for the north-west, where it intergrades with the northern form *M. cucullata picata*.		nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

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flame robin *Petroica phoenicea*	V (TSC)	This species is known to breed in moist eucalypt forests and woodlands. It can usually be seen on ridges and slopes in areas where there is an open understorey layer. This species migrates during the winter to more lowland areas such as grasslands where there are scattered trees, as well as open woodland of the inland slopes and plains.	This robin is located in south-eastern Australia from the Queensland border to Tasmania and into Victoria as well as south-east SA.	Chichester SF Yengo NP	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an 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 hectares.	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	The LWA7–A10 Modification Area supports potential foraging and nesting habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on	No

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					potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
koala *Phascolarctos cinereus*	V (TSC) V (EPBC)	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.	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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no	No

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		Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis, E. microcorys, E. robusta, E. albens, E. camaldulensis and *E. populnea* are some preferred species.		Werakata NP Werakata SCA Yengo NP	potential for an impact on potential habitat for this species.	
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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an 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	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that	No

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		north; moist coastal gullies and creek flats to tall montane forests in the south.		Werakata NP Yengo NP	there will be a significant impact on this species.	
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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 2500km 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 (500km NW of Brisbane) in Queensland.	Watagans NP Heaton SF Olney SF Pokolbin SF Watagans NP Yengo NP	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

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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 LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

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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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	Habitat for this species includes sclerophyll forest. It prefers wet habitats, with trees over 20 metres 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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

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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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an 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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

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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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
Southern myotis *Myotis macropus*	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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No

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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 LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	No
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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

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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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
MIGRATORY SPECIES						
sharp-tailed sandpiper *Calidris acuminata*	MIG (EPBC)	The sharp-tailed sandpiper prefers the edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. Typical habitats include lagoons, swamps, lakes and pools near the coast, dams, waterholes, soaks, bore drains, bore swamps, saltpans and hypersaline saltlakes inland.	The sharp-tailed sandpiper largely spends the non-breeding season in Australia, with a small amount occurring in New Zealand. The majority of the Australian population occurs in the south-east of the country and are widespread in both inland and coastal locations in freshwater and saline habitat.	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be 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	This species is distributed across Australia, China, India, Indonesia, New Guinea, and south-east Asia. Within Australia it is distributed	Werakata NP	The LWA7–A10 Modification Area supports potential foraging habitat for this species.	No

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		(Australian Museum Online 2005).	along and near the coast.		However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	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	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat	No

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		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).			requirements of this species. As such there is no potential for an impact on potential habitat for this species.	
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 NP Yengo NP	The LWA7–A10 Modification Area supports potential foraging habitat for this species. However the LWA7-A10 Modification will not modify habitat requirements of this species. As such there is no potential for an 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	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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a	No

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		up of cobwebs, casuarinas needles, bark, moss and roots (Australian Museum Online2005).			significant impact on this species.	
spectacled monarch *Monarcha trivirgatus*	MAR (EPBC) MIG (EPBC)	This bird is migratory and can typically be identified in dense understories of rainforests, as well as mangroves, riparian vegetation and wet gullies (Australian Museum Online 2005).	The spectacled monarch is distributed from Cape York in Queensland to Port Stephens in NSW. As well as some islands of northern Queensland, the Moluccas, Papua New Guinea and Timor (Australian Museum Online 2005).	This species is not known to occur in any reserves in the region.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on 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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

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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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No
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	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Species	Legal Status	Specific Habitat	Distribution in relation to the LWA7–A10 Modification Area	Reservation in the Region (BioNet 2013)	Occurrence in the LWA7–A10 Modification Area and Potential for Significant Impact	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.	This species has not been recorded within the LWA7–A10 Modification Area and is considered unlikely to occur. It is not likely that there will be a significant impact on this species.	No

Notes:

E:	Endangered
EPBC:	Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
MIG:	Migratory
NP:	National Park
NR:	Nature Reserve
SF:	State Forest
SCA:	State Conservation Area
TSC:	NSW *Threatened Species Conservation Act 1995*
V:	Vulnerable

APPENDIX C

Flora Species List

Appendix C – Flora Species List

The following list was developed from surveys as detailed in Section 2.0 of the main report. It includes all species of vascular plants observed in the original Stage 3 Mine Area (as reported in Umwelt, 2008), the proposed Stage 3 Modification Area (Umwelt, 2011) and the current LWA7–A10 Modification Area (current 2013 surveys). As the LWA7–A10 Modification Area overlap with areas surveyed during previous investigations, it is likely that many of the species recorded previously would also be present in the current LWA7–A10 Modification Area.

However, as the LWA7-A10 Modification is unlikely to have any significant impacts to vegetation, it is unlikely that any of the species identified below would be impacted as a result of the Project. No species identified below are likely to be influenced by the minor extent of subsidence expected as a result of the LWA7-A10 Modification.

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 LWA7–A10 Modification 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 current LWA7–A10 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, 2013), 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	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
Cycadopsida (cycads)					
Zamiaceae	*Macrozamia communis*	burrawang			x
	Macrozamia flexuosa	a burrawang			x
Filicopsida (ferns)					
Blechnaceae	*Doodia aspera*	prickly rasp fern			x
	Doodia linearis	small rasp fern			x
Dennstaedtiaceae	*Pteridium esculentum*	bracken		x	x
Marsileaceae	*Marsilea mutica*	nardoo		x	x
Pteridaceae	*Adiantum aethiopicum*	common maidenhair fern		x	x
	Cheilanthes distans	bristly cloak fern			x
	Cheilanthes sieberi subsp. *sieberi*	poison rock fern	x	x	x
Salviniaceae	*Azolla pinnata*	ferny azolla		x	x
Magnoliopsida (flowering plants) – Liliidae (monocots)					
Anthericaceae	*Dichopogon* sp.		x		
	Laxmannia gracilis	slender wire lily	x		x
	Tricoryne elatior	yellow autumn lily	x		
Asphodelaceae	*Bulbine bulbosa*	bulbine lily			x
Commelinaceae	*Commelina cyanea*	native wandering Jew	x		x
	**Tradescantia fluminensis*	wandering Jew		x	x
Cyperaceae	*Carex appressa*	tall sedge		x	x
	Carex inversa	knob sedge			x
	Carex sp.		x		
	Eleocharis gracilis				x
	Fimbristylis dichotoma	common fringe-sedge			x
	Gahnia aspera	rough saw-sedge			x
	Lepidosperma laterale		x	x	x
Dioscoreaceae	*Dioscorea transversa*	native yam			x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
Hydrocharitaceae	*Ottelia ovalifolia*	swamp lily			x
Iridaceae	*Patersonia sericea*	Silky purple flag	x		
	**Romulea rosea*	onion grass		x	x
Juncaceae	**Juncus acutus* subsp. *acutus*	sharp rush			x
	Juncus usitatus	common rush		x	x
Juncaginaceae	*Triglochin procerum*	water ribbons		x	x
Lemnaceae	*Wolffia* sp.				x
Lomandraceae	*Lomandra confertifolia*	mat rush			x
	Lomandra confertifolia subsp. *pallida*	mat rush	x		x
	Lomandra filiformis subsp. *filiformis*	wattle mat-rush			x
	Lomandra longifolia	spiny-headed mat-rush		x	x
	Lomandra multiflora subsp. *multiflora*	many-flowered mat-rush	x		x
	Lomandra obliqua	fishbones	x		x
Luzuriagaceae	*Eustrephus latifolius*	wombat berry		x	x
	Geitonoplesium cymosum	scrambling lily			x
Orchidaceae	*Acianthus pusillus*	gnat orchid			x
	Caladenia carnea	pink fingers			x
	Caladenia catenata	white caladenia			x
	Caladenia sp.		x		
	Calochilus paludosus	red beard orchid			x
	Calochilus sp.		x		
	Corybas sp.	a helmet orchid			x
	Diuris aurea	a donkey orchid	x		x
	Diuris dendrobioides	wedge diuris			x
	Glossodia major	waxlip orchid			x
	Glossodia minor	small waxlip orchid			x
	Lyperanthus suaveolens	brown beaks	x		x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Pterostylis nutans	nodding greenhood			x
Phormiaceae	*Dianella caerulea*	blue flax-lily	x	x	x
	Dianella longifolia var. *longifolia*	blueberry lilly			x
	Dianella longifolia var. *stenophylla*	blueberry lilly			x
	Dianella revoluta var. *revoluta*		x		
	Dianella sp.				x
Poaceae	*Aristida* sp.	a speargrass	x		x
	Aristida vagans	threeawn speargrass			x
	Austrostipa scabra subsp. *scabra*	speargrass			x
	Austrostipa verticillata	slender bamboo grass			x
	Austrostipa sp.		x		
	**Avena* sp.		x		
	**Bromus* sp.	brome			x
	**Chloris gayana*	Rhodes grass	x		x
	Cymbopogon refractus	barbed wire grass			x
	Cynodon dactylon	common couch		x	x
	Dichanthium sericeum subsp. *sericeum*	Queensland blue grass			x
	Dichelachne micrantha	shorthair plumegrass	x		
	Digitaria sp.				x
	Echinopogon caespitosus var. *caespitosus*	tufted hedgehog grass			x
	Echinopogon ovatus	forest hedgehog grass	x		x
	**Ehrharta erecta*	panic veldtgrass		x	x
	Entolasia marginata	bordered panic			x
	Entolasia stricta	wiry panic			x
Poaceae	*Eragrostis leptostachya*	paddock lovegrass			x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Eragrostis sp.	a lovegrass	x		x
	Imperata cylindrica var. *major*	blady grass	x	x	x
	Microlaena stipoides var. *stipoides*	weeping grass		x	x
	Oplismenus aemulus	basket grass	x		X
	Panicum effusum	hairy panic	x		
	Panicum simile	two-colour panic			x
	Panicum sp.				x
	**Pennisetum clandestinum*	kikuyu grass		x	x
	Rytidosperma caespitosa	ringed wallaby grass			x
	Rytidosperma fulvum		x		
	Rytidosperma setaceum	small flower wallaby grass	x		
	Rytidosperma sp.	a wallaby grass			x
	Setaria sp.	pigeon grass			x
	Sporobolus creber	slender rats tail grass			x
	**Stenotaphrum secundatum*	buffalo grass			x
	Themeda australis	kangaroo grass	x		x
Typhaceae	*Typha orientalis*	broad-leaved cumbungi			x
Xanthorrhoeaceae	*Xanthorrhoea* sp.	a grass tree	x		x
Magnoliopsida (flowering plants) – Magnoliidae (dicots)					
Acanthaceae	*Brunoniella australis*	blue trumpet	x	x	x
	Pseuderanthemum variabile	pastel flower			x
Amaranthaceae	*Alternanthera denticulata*	lesser joyweed			x
Apiaceae	*Centella asiatica*	pennywort			x
	Trachymene incisa subsp. *incisa*				x
	Xanthosia pilosa	woolly xanthosia			x
Apocynaceae	*Parsonsia straminea*	common silkpod		x	x
	**Gomphocarpus fruticosus*	narrow-leaved cotton bush			x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
Asteraceae	*Ambrosia* sp.	a lacy ragweed		x	x
	**Bidens pilosa*	cobblers pegs	x		x
	**Carthamus lanatus*	saffron thistle			x
	Cassinia sp.		x		x
	Chrysocephalum apiculatum	common everlasting			x
	**Conyza albida*	tall fleabane			x
	**Conyza* sp.	a fleabane			x
	Coronidium scorpioides	button everlasting	x		
	Cotula australis	common cotula		x	x
	Euchiton gymnocephalus	star cudweed	x		
	**Facelis retusa*			x	x
	**Gamochaeta americana*	cudweed		x	x
	**Gamochaeta pensylvanica*	cudweed			x
	Helichrysum rutidolepis	pale everlasting			x
	Helichrysum scorpioides	button everlasting			x
	**Hypochoeris radicata*	catsear			x
	Lagenifera gracilis	slender lagenophora	x		x
	Olearia elliptica	sticky daisy bush			x
	**Onopordum acanthium* subsp. *acanthium*	Scotch thistle			x
	Ozothamnus diosmifolius	white dogwood			x
	Rutidosis heterogama	**heath wrinklewort**	**x**		**x**
	**Senecio madagascariensis*	fireweed		x	x
	Sigesbeckia orientalis subsp. *orientalis*	Indian weed			x
	**Silybum marianum*	variegated thistle			x
Asteraceae	**Sonchus oleraceus*	common sowthistle		x	x
	**Taraxacum officinale*	dandelion		x	x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Vernonia cinerea var. *cinerea*		x		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		x
Campanulaceae	*Wahlenbergia gracilis*	sprawling or Australian bluebell			x
	Wahlenbergia sp.				x
	Wahlenbergia stricta	tall bluebell			x
Caryophyllaceae	**Cerastium glomeratum*	mouse-ear chickweed			x
	**Paronychia brasiliana*	Chilean whitlow wort			x
	**Petrorhagia velutina*	pink velvet			x
	**Stellaria media*	common chickweed		x	x
	Stellaria pungens	prickly starwort			x
Casuarinaceae	*Allocasuarina littoralis*	black sheoak			x
	Allocasuarina torulosa	forest oak	x		x
	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
	Chenopodium pumilio	small crumbweed			x
	Einadia hastata	berry saltbush	x	x	x
	Einadia nutans subsp. *linifolia*	climbing saltbush			x
	Einadia trigonos subsp. *trigonos*	fishweed			x
Clusiaceae	*Hypericum gramineum*	small St Johns wort			x
Convolvulaceae	*Convolvulus erubescens*	blushing bindweed	x		
	Dichondra repens	kidney weed	x	x	x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
Cunoniaceae	*Aphanopetalum resinosum*	gum vine			x
Dilleniaceae	*Hibbertia acicularis*		x		
	Hibbertia aspera	rough Guinea flower	x		x
	Hibbertia linearis	a Guinea flower			
	Hibbertia pedunculata	a Guinea flower			x
Droseraceae	*Drosera peltata*	sundew	x		x
Elaeocarpaceae	*Elaeocarpus obovatus*	hard quandong			x
Ericaceae (Styphelioideae)	*Acrotriche divaricata*	ground berry			x
	Astroloma humifusum	native cranberry			x
	Brachyloma daphnoides	daphne heath	x		
	Lissanthe strigosa	peach heath	x		x
	Melichrus urceolatus	urn heath		x	
	Styphelia triflora	pink five-corners	x		x
Euphorbiaceae	*Breynia oblongifolia*	coffee bush		x	x
	Phyllanthus gunnii	shrubby spurge			
	Phyllanthus hirtellus	thyme spurge	x		x
	Poranthera microphylla	small poranthera			x
Fabaceae (Faboideae)	*Bossiaea obcordata*	spiny bossiaea			x
	Bossiaea prostrata	a bossiaea			x
	Bossiaea rhombifolia				
	Daviesia genistifolia	broom bitter pea			x
	Daviesia ulicifolia subsp. *ulicifolia*	gorse bitter pea		x	x
	Desmodium gunnii	slender tick-trefoil	x		x
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*	rusty tick-trefoil			x
	Desmodium varians	slender tick-trefoil	x	x	x
	Dillwynia retorta	eggs and bacon			x
	Glycine clandestina	twining glycine	x		x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Glycine latifolia	a glycine			x
	Glycine microphylla	small-leaf glycine			x
	Glycine tabacina	variable glycine	x	x	x
	Gompholobium minus	dwarf wedge pea			x
	Hardenbergia violacea	false sarsaparilla	x	x	x
	Hovea linearis	narrow-leaf hovea	x		x
	Indigofera australis	Australian indigo			x
	Jacksonia scoparia	dogwood			x
	Kennedia rubicunda	red Kennedy pea			x
	Mirbelia rubiifolia	heathy mirbelia			x
	Oxylobium pulteneae	wiry shaggy pea			x
	Podolobium ilicifolium	prickly shaggy pea			x
	Podolobium scandens	netted shaggy pea			x
	Pultenaea palacea				x
	Pultenaea villosa	grey bush-pea			x
	**Trifolium arvense*	haresfoot clover			x
	**Trifolium repens*	white clover		x	x
Fabaceae (Mimosoideae)	*Acacia binervata*	two-veined hickory			x
	Acacia deanei subsp. *deanei*	Deanes wattle			x
	Acacia decurrens	black wattle			x
	Acacia falcata	sickle wattle			x
Fabaceae (Mimosoideae)	*Acacia floribunda*	white Sally			x
	Acacia implexa	hickory wattle			x
	Acacia linifolia	white wattle			x
	Acacia longifolia var. *longifolia*	Sydney golden wattle	x		x
	Acacia longissima	narrow-leaved wattle			x
	Acacia parvipinnula	silver-stemmed wattle	x		x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Acacia sp.				x
	Acacia terminalis subsp*. longiaxialis*	sunshine wattle			x
	Acacia ulicifolia	prickly Moses wattle			x
	Neptunia gracilis	native sensitive plant			x
Geraniaceae	*Geranium solanderi* var. *solanderi*	native geranium			x
	Geranium sp.		x		x
Goodeniaceae	*Goodenia rotundifolia*	a goodenia			x
Haloragaceae	*Gonocarpus tetragynus*	a raspwort	x		x
Lamiaceae	*Plectranthus parviflorus*	native cockspur		x	x
Lauraceae	*Cassytha glabella*	devils twine			x
	Cassytha pubescens	devils twine	x		x
Lobeliaceae	*Pratia purpurascens*	whiteroot	x	x	x
Loranthaceae	*Amyema gaudichaudii*	paper-bark mistletoe			x
	Amyema sp.	a mistletoe			x
Malvaceae	**Modiola caroliniana*	red-flowered mallow		x	x
	**Sida rhombifolia*	Paddys lucerne	x	x	x
Myoporaceae	*Eremophila debilis*	winter apple	x		x
Myrsinaceae	*Myrsine howittiana*	brush muttonwood			x
Myrtaceae	*Angophora bakeri*	narrow-leaved apple			x
	Angophora floribunda	rough-barked apple	x	x	x
	Backhousia myrtifolia	grey myrtle			x
	Callistemon* prob*. linearifolius	**probable netted bottle-brush**	**X**		
	Callistemon linearis	narrow-leaved bottlebrush			x
	Corymbia eximia	yellow bloodwood			x
	Corymbia maculata	spotted gum	x		x
	Eucalyptus acmenoides	white mahogany			x
	Eucalyptus amplifolia subsp. *amplifolia*	cabbage gum		x	x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Eucalyptus amplifolia X *tereticornis*				x
	Eucalyptus canaliculata	large-fruited grey gum		x	x
	Eucalyptus crebra	narrow-leaved ironbark			x
	Eucalyptus eugenioides	thin-leaved stringybark	x		x
	Eucalyptus fergusonii subsp. *fergusonii*	an ironbark			x
	Eucalyptus fibrosa	red ironbark	x	x	x
	Eucalyptus globoidea	white stringybark			x
	Eucalyptus longifolia	woollybutt			x
	Eucalyptus moluccana	grey box	x	x	x
	Eucalyptus ?microcarpa		x		
	Eucalyptus piperita	Sydney peppermint			x
	Eucalyptus punctata	grey gum	x		x
Myrtaceae	*Eucalyptus punctata* x *canaliculata*				x
	Eucalyptus racemosa	narrow-leaved scribbly gum			x
	Eucalyptus resinifera	red mahogany			x
	Eucalyptus siderophloia	grey ironbark			x
	Eucalyptus tereticornis	forest red gum			x
	Eucalyptus umbra	broad-leaved white mahogany			x
	Kunzea parviflora	violet kunzea			x
	Leptospermum parvifolium	small-leaf tea-tree			x
	Leptospermum polygalifolium subsp. *cismontanum*	lemon-scented tea tree			x
	Leptospermum trinervium	paperbark tea tree			x
	Melaleuca decora	ball honeymyrtle		x	x
	Melaleuca linariifolia	snow in summer		x	x
	Melaleuca nodosa	ball honeymyrtle		x	x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Melaleuca sieberi	Siebers paperbark			x
	Melaleuca styphelioides	prickly-leaved tea tree		x	x
	Melaleuca thymifolia	thyme honeymyrtle			x
	Melaleuca sp.		x		
	Syncarpia glomulifera subsp. *glomulifera*	turpentine	x	x	x
Oleaceae	*Jasminum volubile*	stiff jasmine			x
	Notelaea longifolia	large mock-olive			x
	Notelaea venosa	veined mock olive			x
Oxalidaceae	*Oxalis chnoodes*	a wood sorrel			x
	Oxalis exilis	a wood sorrel		x	x
	Oxalis perennans	grassland wood sorrel		x	x
Phytolaccaceae	**Phytolacca octandra*	inkweed			x
Pittosporaceae	*Billardiera scandens* var. *scandens*	apple berry	x		x
	Bursaria spinosa var. *spinosa*	blackthorn	x	x	x
Plantaginaceae	*Plantago debilis*	common plantain			x
	**Plantago lanceolata*	lambs tongues	x	x	x
	**Plantago myosuros* subsp. *myosuros*	a plantain			x
	Veronica plebeia	trailing speedwell	x		
Polygonaceae	*Rumex brownii*	swamp dock			x
	**Rumex crispus*	curled dock		x	x
Primulaceae	**Anagallis arvensis*	scarlet/blue pimpernel		x	x
Proteaceae	*Banksia spinulosa* var. *collina*	hairpin banksia	x		x
	Grevillea montana	a grevillea			x
	Grevillea parviflora* subsp. *parviflora	**small-flower grevillea**	**x**		**x**
	Grevillea sericea subsp. sericea	pink spider flower			x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Hakea dactyloides	finger hakea, broad-leaved hakea			x
	Hakea sericea	needlebush	x		x
	Persoonia linearis	narrow-leaved geebung	x		x
Ranunculaceae	*Clematis glycinoides*	headache vine	x		x
	Ranunculus inundatus	river buttercup			x
Rosaceae	**Rosa rubiginosa*	sweet briar		x	x
	**Rubus fruticosus* sp. agg.	blackberry complex	x	x	x
	Rubus parvifolius	native raspberry	x		x
Rubiaceae	*Asperula conferta*	common woodruff	x	x	x
	Galium propinquum	Maori bedstraw			x
	Opercularia aspera	coarse stinkweed			x
	Pomax umbellata	pomax	x		x
	**Richardia stellaris*	field madder			x
Rutaceae	*Boronia parviflora*	swamp boronia			x
	Boronia polygalifolia	dwarf boronia			x
	Melicope micrococca	hairy-leaved doughwood			x
	Phebalium squamulosum subsp. *squamulosum*	scaly phebalium			x
Santalaceae	*Exocarpos cupressiformis*	native cherry			x
	Exocarpos strictus	dwarf cherry			x
	Leptomeria acida	native currant			
Sapindaceae	*Dodonaea triquetra*	large-leaf hop-bush			x
Solanaceae	*Solanum brownii*	violet nightshade			x
	Solanum cinereum	Narrawa burr			x
	**Solanum mauritianum*	wild tobacco bush		x	x
	**Solanum nigrum*	black-berry nightshade		x	x

Family/Sub Family	Scientific Name	Common Name	Current LWA7–A10 Modification Area (Umwelt 2013)	Stage 3 Modification Area – Survey (Umwelt 2011)	Original Stage 3 Mine Area (Umwelt 2008)
	Solanum prinophyllum	forest nightshade	x		x
	Solanum pungetium	eastern nightshade			x
Stackhousiaceae	*Stackhousia muricata*	western stackhousia			x
	Stackhousia viminea	slender stackhousia			x
Sterculiaceae	*Brachychiton populneus* subsp. *populneus*	kurrajong			x
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	slender rice flower			x
Verbenaceae	*Clerodendrum tomentosum*	hairy clerodendrum,			x
	**Lantana camara*	lantana	x		x
	**Verbena bonariensis*	purpletop	x	x	x
Violaceae	*Viola hederacea*	ivy-leaved violet	x	x	x
Vitaceae	*Cayratia clematidea*	slender grape			x
	Cissus antarctica	water vine			x

APPENDIX D

Fauna Species List

Appendix D – Fauna Species List

The following list was developed from surveys as detailed in **Section 2** of the main report. It includes all fauna species observed in the original Stage 3 Mine Area (as reported in Umwelt, 2008), the Stage 3 Modification Area (Umwelt, 2011) and the current LWA7–A10 Modification Area (current 2013 field surveys). As the newly LWA7–A10 Modification Area overlap with areas surveyed during previous inspections, it is likely that many of the species recorded previously would also be present in the current LWA7–A10 Modification Area.

However, as the LWA7–A10 Modification is unlikely to have any significant impacts to habitat, it is unlikely that any of the species identified below would be impacted as a result of the Project. All threatened species identified below are highly mobile and unlikely to be influenced by a minor extent of subsidence.

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

The following abbreviations or symbols are used in the list:

asterisk (*) denotes species not indigenous;

MIG Listed migratory species under the *Environment Protection and Biodiversity Conservation Act 1999* (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 BirdLife 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 2008), Proposed Modification Area (Umwelt 2011) and Current LWA7-A10 Modification Study Area (Umwelt 2013)

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
BIRDS						
Anatidae						
Cygnus atratus	black swan				X	
Chenonetta jubata	Australian wood duck			X	X	X
Anas superciliosa	Pacific black duck			X		
Anas gracilis	grey teal			X		
Podicipedidae						
Tachybaptus novaehollandiae	Australasian grebe			X		X
Phalacrocoracidae						
Phalacrocorax melanoleucos	little pied cormorant				X	
Phalacrocorax sulcirostris	little black cormorant			X		
Pelecanidae						
Pelecanus conspicillatus	Australian pelican			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**	**X**		
Aquila audax	wedge-tailed eagle			X		
Falconidae						
Falco cenchroides	nankeen kestrel				X	
Rallidae						
Porphyrio porphyrio	purple swamphen			X	X	
Gallinula tenebrosa	dusky moorhen			X		
Fulica atra	Eurasian coot			X		

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
Charadriidae						
Vanellus miles	masked lapwing			X	X	
Columbidae						
Ocyphaps lophotes	crested pigeon			X	X	
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	X
Trichoglossus haematodus	rainbow lorikeet			X		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		X

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
Sericornis frontalis	white-browed scrubwren			X		
Chthonicola sagittata	**speckled warbler**	**V**		**X**		
Acanthiza chrysorrhoa	yellow-rumped thornbill			X		
Acanthiza lineata	striated thornbill			X		
Acanthiza nana	yellow thornbill				X	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	X
Meropidae						
Merops ornatus	**rainbow bee-eater**		**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	**grey-crowned**	**V**		**X**		

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
temporalis temporalis	**babbler (eastern subspecies)**					
Neosittidae						
Pachycephala pectoralis	golden whistler					
Pachycephala rufiventris	rufous whistler			X		
Dicruridae						
Myiagra cyanoleuca	**satin flycatcher**		**MIG**	**X**		
Grallina cyanoleuca	magpie-lark			X	X	X
Rhipidura leucophrys	willie wagtail				X	
Rhipidura fuliginosa	grey fantail			X		X
Campephagidae						
Coracina novaehollandiae	black-faced cuckoo-shrike			X		
Oriolidae						
Oriolus sagittatus	olive-backed oriole					
Cuculidae						
Scythrops novaehollandiae	channel-billed cuckoo			X		
Artamidae						
Cracticus torquatus	grey butcherbird				X	X
Cracticus nigrogularis	pied butcherbird			X	X	
Gymnorhina tibicen	Australian magpie			X	X	X
Strepera graculina	pied currawong			X	X	
Corvidae						
Corvus coronoides	Australian raven			X	X	X
Corcoracidae						
Corcorax melanorhamphos	white-winged chough			X	X	X
Motacillidae						
Anthus novaeseelandiae	Richards pipit					
Passeridae						
Taeniopygia bichenovii	double-barred finch			X		
Hirundinidae						
Hirundo neoxena	welcome swallow			X		
Sturnidae						
**Sturnus tristus*	common myna				X	

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
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		
Carlia tetradactyla	southern rainbow skink			X		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						
Vombatidae						
Vombatus ursinus	wombat					X
Pteropodidae						
Pteropus poliocephalus	**grey-headed flying fox**	**V**	**V**	**X**		
Phalangeridae						
Trichosurus vulpecula	common brushtail possum			X		
Macropodidae						
Macropus giganteus	eastern grey kangaroo			X	X	
Macropus robustus	wallaroo					X

Scientific Name	Common Name	Status		Survey		
		TSC Act	EPBC Act	Original Stage 3 Mining Area (Umwelt 2008)	Stage 3 Mine Area – Modification (Umwelt 2011)	Current Survey of LWA7–A10 Modification Area (Umwelt 2013)
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 macropus	**southern myotis**	**V**		**X**		
Falsistrellus tasmaniensis	**eastern false-pipistrelle**	**V**		**X**		
Nyctophilus gouldi	Goulds long-eared bat			X		
Scotorepens balstoni	inland broad-nosed bat			poss.		
Scotorepens orion	eastern broad-nosed bat			X		
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		
Canidae						
**Vulpes vulpes*	fox			X		
Leporidae						
**Oryctolagus cuniculus*	rabbit			X	X	X

APPENDIX E

Seven Part Test of Significance –
Environmental Planning and Assessment Act 1979

Appendix E – Seven Part Test of Significance – *Environmental Planning and Assessment Act 1979*

Those species considered to have reasonable potential to occur within the LWA7–A10 Modification Area (based on known distribution and habitat requirements) and with reasonable potential to be impacted by the Project are addressed in more detail in the following 'Seven Part Test of Significance'. All species listed under the EPBC Act requiring further assessment are considered in a separate assessment provided in **Appendix F**.

Threatened species and TECs included under this assessment include:

- Threatened Ecological Communities:
  - Lower Hunter Spotted Gum Ironbark Forest EEC;
- Known threatened Flora Species:
  - Small-flower Grevillea (*Grevillea parviflora* subsp*. parviflora*);
  - Heath wrinklewort (*Rutidosis heterogama*); and
  - Netted bottlebrush (*Callistemon* prob*. linearifolius*);
- Potentially occurring threatened fauna species:
  - Swift parrot (*Lathamus discolor*); and
  - Regent honeyeater (*Anthochaera phrygia*).

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

Lower Hunter Spotted Gum – Ironbark Forest EEC occurs in the LWA7–A10 Modification Area on the drier slopes and ridges. In the north of the LWA7–A10 Modification Area, some parts of this EEC lie within Werakata State Conservation Area (SCA). Large areas of this EEC are protected in the SCA and elsewhere in the locality and region.

The extension of Longwalls A7, A8, A9 and A10 will cause subsidence to approximately 16.7 hectares of Lower Hunter Spotted Gum – Ironbark Forest EEC that would not have been previously subject to subsidence (Umwelt, 2011).

There is no proposed vegetation clearing as part of the LWA7–A10 Modification. Subsidence as a result of longwall mining is expected to occur relatively uniformly across the LWA7–A10 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, it is not likely that the LWA7–A10 Modification will result in the loss or modification of any areas of the Lower Hunter Spotted Gum – Ironbark Forest EEC such that the local occurrence of the community will 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 LWA7–A10 Modification 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 LWA7–A10 Modification 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, and

The LWA7–A10 Modification will not lead to the removal or modification of habitat for the Lower Hunter Spotted Gum – Ironbark Forest EEC. It is predicted that the LWA7–A10 Modification 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 LWA7–A10 Modification 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.

(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 extension of Longwalls A7, A8, A9 and A10 will cause subsidence to approximately 16.7 hectares of Lower Hunter Spotted Gum – Ironbark Forest EEC that would not have been previously subject to subsidence (Umwelt, 2011).

The Lower Hunter Spotted Gum – Ironbark Forest EEC present ranges in quality 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 Mining Area.

Given that the LWA7–A10 Modification 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.

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 LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining' and 'Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands'. Given that the predicted surface impacts of the LWA7–A10 Modification 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.

Conclusion

It is not anticipated that the LWA7–A10 Modification will have a significant impact on Lower Hunter Spotted Gum Ironbark Forest EEC.

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

Small-flower grevillea (*Grevillea parviflora* subsp*. parviflora*) is listed as a vulnerable species under the TSC Act and is known to occur in the northern areas of the LWA7–A10 Modification Area. It is considered that this species has the potential to occur at locations other than that identified in the main text.

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 the northern areas of the LWA7–A10 Modification Area in the areas of higher quality habitat in Lower Hunter Spotted Gum – Ironbark Forest. This threatened flora species is known to be widespread within Werakata State Conservation Area. Its occurrence within the LWA7–A10 Modification Area is likely to be part of a larger viable local population.

Subsidence modeling and predication indicate that the subsidence will occur relatively uniformly across the LWA7–A10 Modification Area, therefore the LWA7–A10 Modification will cause very little disturbance of surface or groundwater flow patterns. The secondary impacts of subsidence are also predicted to be very minor. There will be no loss of vegetation as a direct result of clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Consequently, the LWA7–A10 Modification will not have an adverse effect on the life cycle of small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) such that a viable local population is likely to be placed at risk of extinction.

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

Not applicable as small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) is not an endangered population.

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 as small-flower grevillea (*Grevillea parviflora* subsp. *parviflora* is not an endangered ecological community.

(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 as small-flower grevillea (*Grevillea parviflora* subsp. *parviflora* is not an endangered ecological community.

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

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

Habitat for the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) within the LWA7–A10 Modification Area will not be removed or modified as a result of the LWA7–A10 Modification. There is minimal potential for the habitats this species occurs within to be impacted by subsidence, consequently any extent of habitat for this species modified will be minimal.

(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*), 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 habitats for small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) occur in the Lower Hunter Spotted Gum – Ironbark Forest of the LWA7–A10 Modification Area; however this community occurs widely within the locality in adjacent areas to the LWA7–A10 Modification Area where it is also known to occur. These habitats are in similar, and in many cases higher conservation value than those habitats of the LWA7–A10 Modification Area. The habitat for the small-flower grevillea (*Grevillea parviflora* subsp. *parviflora*) is highly unlikely to be modified as a result of the LWA7–A10 Modification.

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

The LWA7–A10 Modification Area does not contain any areas of critical habitat, and there are no known areas of critical habitat within the local area which could be affected by the LWA7–A10 Modification.

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

There are no current recovery plans or threat abatement plans for this species.

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

There is one KTP most relevant to the LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining'. Given that the predicted surface impacts of the LWA7–A10 Modification will be very minor, the implication of this KTP are not constraining, however this would need to be continually reviewed and managed as mining progresses.

While the establishment of the LWA7–A10 Modification will involve the operation of a KTP, the impacts of this are not regarded to be significant in relation to loss of habitat for small-flower grevillea (*Grevillea parviflora* subsp*. parviflora*).

Conclusion

It is considered unlikely that the LWA7–A10 Modification would result in a significant impact on small-flower grevillea (*Grevillea parviflora* subsp*. parviflora*) as no direct clearing will occur as a result of the LWA7–A10 Modification and subsidence related impacts are not anticipated to impact vegetation or habitat.

Heath Wrinklewort (*Rutidosis heterogama*)

Heath wrinklewort (*Rutidosis heterogama*) is listed as a vulnerable species under the TSC Act and is known to occur in the northern areas of the LWA7–A10 Modification Area. It is considered that this species has the potential to occur at locations other than that identified in the main text.

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 the northern areas of the LWA7–A10 Modification Area in the areas of higher quality habitat in Lower Hunter Spotted Gum – Ironbark Forest. This threatened flora species is known to be widespread within Werakata State Conservation Area. Its occurrence within the LWA7–A10 Modification Area is likely to be part of a larger viable local population.

Subsidence modeling and predication indicate that the subsidence will occur relatively uniformly across the LWA7–A10 Modification Area, therefore the LWA7–A10 Modification will cause very little disturbance of surface or groundwater flow patterns. The secondary impacts of subsidence are also predicted to be very minor. There will be no loss of vegetation as a direct result of clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Consequently, the LWA7–A10 Modification will not have an adverse effect on the life cycle of heath wrinklewort (*Rutidosis heterogama*) such that a viable local population is likely to be placed at risk of extinction.

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

Not applicable as heath wrinklewort (*Rutidosis heterogama*) is not an endangered population.

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 as heath wrinklewort (*Rutidosis heterogama*) is not an endangered ecological community.

(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 as heath wrinklewort (*Rutidosis heterogama*) is not an endangered ecological community.

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

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

Habitat for heath wrinklewort (*Rutidosis heterogama*) within the LWA7–A10 Modification Area will not be removed or modified as a result of the LWA7–A10 Modification. There is minimal potential for the habitats this species occurs within to be impacted by subsidence, consequently any extent of habitat for this species modified will be minimal.

(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*), 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 habitats for heath wrinklewort (*Rutidosis heterogama*) occur in the Lower Hunter Spotted Gum – Ironbark Forest of the LWA7–A10 Modification Area; however this community occurs widely within the locality in adjacent areas to the LWA7–A10 Modification Area where it is also known to occur. These habitats are in similar, and in many cases higher conservation value than those habitats of the LWA7–A10 Modification Area. The habitat for heath wrinklewort (*Rutidosis heterogama*) is highly unlikely to be modified as a result of the LWA7–A10 Modification.

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

The LWA7–A10 Modification Area does not contain any areas of critical habitat, and there are no known areas of critical habitat within the local area which could be affected by the LWA7–A10 Modification.

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

There are no current recovery plans or threat abatement plans for this species.

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

There is one KTP most relevant to the LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining'. Given that the predicted surface impacts of the LWA7–A10 Modification will be very minor, the implication of this KTP are not constraining, however this would need to be continually reviewed and managed as mining progresses.

While the establishment of the LWA7–A10 Modification will involve the operation of a KTP, the impacts of this are not regarded to be significant in relation to loss of habitat for heath wrinklewort (*Rutidosis heterogama*).

Conclusion

It is considered unlikely that the LWA7–A10 Modification would result in a significant impact on heath wrinklewort (*Rutidosis heterogama*) as no direct clearing will occur as a result of the LWA7–A10 Modification and subsidence related impacts are not anticipated to impact vegetation or habitat.

Netted Bottle-brush (*Callistemon linearifolius*)

Netted bottle brush (*Callistemon linearifolius*) is listed as a vulnerable species under the TSC Act and is known to occur in the northern areas of the LWA7–A10 Modification Area. It is considered that this species has the potential to occur at locations other than that identified in the main text.

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,

Netted bottle brush (*Callistemon linearifolius*) was found in the northern areas of the LWA7–A10 Modification Area in the areas of higher quality habitat in Lower Hunter Spotted Gum – Ironbark Forest. This threatened flora species is known to be widespread within Werakata State Conservation Area. Its occurrence within the LWA7–A10 Modification Area is likely to be part of a larger viable local population.

Subsidence modeling and predication indicate that the subsidence will occur relatively uniformly across the LWA7–A10 Modification Area, therefore the LWA7–A10 Modification will cause very little disturbance of surface or groundwater flow patterns. The secondary impacts of subsidence are also predicted to be very minor. There will be no loss of vegetation as a direct result of clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Consequently, the LWA7–A10 Modification will not have an adverse effect on the life cycle of netted bottle brush (*Callistemon linearifolius*) such that a viable local population is likely to be placed at risk of extinction.

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

Not applicable as netted bottle brush (*Callistemon linearifolius*) is not an endangered population.

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 as netted bottle brush (*Callistemon linearifolius*) is not an endangered ecological community.

(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 as netted bottle brush (*Callistemon linearifolius*) is not an endangered ecological community.

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

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

Habitat for netted bottle brush (*Callistemon linearifolius*) within the LWA7–A10 Modification Area will not be removed or modified as a result of the Proposed Modification. There is minimal potential for the habitats this species occurs within to be impacted by subsidence, consequently any extent of habitat for this species modified will be minimal.

(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 netted bottle brush (*Callistemon linearifolius*) 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 habitats for netted bottle brush (*Callistemon linearifolius*) occur in the Lower Hunter Spotted Gum – Ironbark Forest of the LWA7–A10 Modification Area; however this community occurs widely within the locality in adjacent areas to the LWA7–A10 Modification Area where it is also known to occur. These habitats are in similar, and in many cases higher conservation value than those habitats of the Proposed Modification Area. The habitat for netted bottle brush (*Callistemon linearifolius*) is highly unlikely to be modified as a result of the LWA7–A10 Modification.

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

The LWA7–A10 Modification Area does not contain any areas of critical habitat, and there are no known areas of critical habitat within the local area which could be affected by the LWA7–A10 Modification.

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

There are no current recovery plans or threat abatement plans for this species.

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

There is one KTP most relevant to the LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining'. Given that the predicted surface impacts of the LWA7–A10 Modification will be very minor, the implication of this KTP are not constraining, however this would need to be continually reviewed and managed as mining progresses.

While the establishment of the LWA7–A10 Modification will involve the operation of a KTP, the impacts of this are not regarded to be significant in relation to loss of habitat for netted bottle brush (*Callistemon linearifolius*).

Conclusion

It is considered unlikely that the LWA7–A10 Modification would result in a significant impact on netted bottle brush (*Callistemon linearifolius*) as no direct clearing will occur as a result of the LWA7–A10 Modification and subsidence related impacts are not anticipated to impact vegetation or habitat.

Swift Parrot (*Lathamus discolor*)

The swift parrot (*Lathamus discolor*) is listed as an endangered species under the TSC Act and is likely to occur throughout the areas of Lower Hunter Spotted Gum - Ironbark Forest in the LWA7–A10 Modification Area. It is considered that this species has the potential to occur at locations other than that identified in the main text. Although this species has the potential to occur, it is unlikely to be significantly impacted by the LWA7-A10 Modification; however due to its level of threat and sensitivity to environmental change a full Seven Part Test of Significance was undertaken.

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 swift parrot (*Lathamus discolor*) is likely to occur in the areas of higher quality habitat in Lower Hunter Spotted Gum – Ironbark Forest. This threatened species is known to use the habitats of Werakata State Conservation Area. Its occurrence within the LWA7–A10 Modification Area would likely only be as part of a much larger foraging range.

Subsidence modeling and predication indicate that the subsidence will occur relatively uniformly across the LWA7–A10 Modification Area, therefore the LWA7–A10 Modification will cause very little disturbance of surface or groundwater flow patterns. The secondary impacts of subsidence are also predicted to be very minor. There will be no loss of vegetation as a direct result of clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Consequently, the LWA7–A10 Modification will not have an adverse effect on the life cycle of swift parrot (*Lathamus discolor*) such that a viable local population is likely to be placed at risk of extinction.

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

Not applicable as the swift parrot (*Lathamus discolor*) is not an endangered population.

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 as the swift parrot (*Lathamus discolor*) is not an endangered ecological community.

(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 as the swift parrot (*Lathamus discolor*) is not an endangered ecological community.

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

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

Habitat for the swift parrot (*Lathamus discolor*) within the LWA7–A10 Modification Area will not be removed or modified as a result of the LWA7–A10 Modification. There is minimal potential for the habitats this species occurs within to be impacted by subsidence, consequently any extent of habitat for this species modified will be minimal.

(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 swift parrot (*Lathamus discolor*), 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 habitats for swift parrot (*Lathamus discolor*) occur in the Lower Hunter Spotted Gum – Ironbark Forest of the LWA7–A10 Modification Area; however this community occurs widely within the locality in adjacent areas to the LWA7–A10 Modification Area where it is also known to occur. These habitats are in similar, and in many cases higher conservation value than those habitats of the LWA7–A10 Modification Area. The habitat for swift parrot (*Lathamus discolor*) is highly unlikely to be modified as a result of the LWA7–A10 Modification.

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

The LWA7–A10 Modification Area does not contain any areas of critical habitat, and there are no known areas of critical habitat within the local area which could be affected by the LWA7–A10 Modification.

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 LWA7–A10 Modification. However, the LWA7–A10 Modification 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 is one KTP most relevant to the LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining'. Given that the predicted surface impacts of the LWA7–A10 Modification will be very minor, the implication of this KTP are not constraining, however this would need to be continually reviewed and managed as mining progresses.

While the establishment of the LWA7–A10 Modification will involve the operation of a KTP, the impacts of this are not regarded to be significant in relation to loss of habitat for swift parrot (*Lathamus discolor*).

Conclusion

It is considered unlikely that the LWA7–A10 Modification would result in a significant impact on swift parrot (*Lathamus discolor*) as no direct clearing will occur as a result of the LWA7–A10 Modification and subsidence related impacts are not anticipated to impact vegetation or habitats.

Regent Honeyeater (*Anthochaera phrygia*)

The regent honeyeater (*Anthochaera phrygia*) is listed as an endangered species under the TSC Act and is likely to occur throughout the areas of Lower Hunter Spotted Gum - Ironbark Forest in the LWA7–A10 Modification Area. It is considered that this species has the potential to occur at locations other than that identified in the main text.

Although this species has the potential to occur, it is unlikely to be significantly impacted by the LWA7-A10 Modification; however due to its level of threat and sensitivity to environmental change a full Seven Part Test of Significance was undertaken.

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 regent honeyeater (*Anthochaera phrygia*) is likely to occur in the areas of higher quality habitat in Lower Hunter Spotted Gum – Ironbark Forest. This threatened species is known to use the habitats of Werakata State Conservation Area. Its occurrence within the LWA7–A10 Modification Area would likely only be as part of a much larger foraging range.

Subsidence modeling and predication indicate that the subsidence will occur relatively uniformly across the LWA7–A10 Modification Area, therefore the LWA7–A10 Modification will cause very little disturbance of surface or groundwater flow patterns. The secondary impacts of subsidence are also predicted to be very minor. There will be no loss of vegetation as a direct result of clearing, and it is very unlikely that subsidence will lead to loss of vegetation or modification of habitats.

Consequently, the LWA7–A10 Modification will not have an adverse effect on the life cycle of the regent honeyeater (*Anthochaera phrygia*) such that a viable local population is likely to be placed at risk of extinction.

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

Not applicable as the regent honeyeater (*Anthochaera phrygia*) is not an endangered population.

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 as the regent honeyeater (*Anthochaera phrygia*) is not an endangered ecological community.

(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 as the regent honeyeater (*Anthochaera phrygia*) is not an endangered ecological community.

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

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

Habitat for the regent honeyeater (*Anthochaera phrygia*) within the LWA7–A10 Modification Area will not be removed or modified as a result of the LWA7–A10 Modification. There is minimal potential for the habitats this species occurs within to be impacted by subsidence, consequently any extent of habitat for this species modified will be minimal.

(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 regent honeyeater (*Anthochaera phrygia*), 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 habitats for regent honeyeater (*Anthochaera phrygia*) occur in the Lower Hunter Spotted Gum – Ironbark Forest of the LWA7–A10 Modification Area; however this community occurs widely within the locality in adjacent areas to the LWA7–A10 Modification Area where it is also known to occur. These habitats are in similar, and in many cases higher conservation value than those habitats of the LWA7–A10 Modification Area. The habitat for regent honeyeater (*Anthochaera phrygia*) is highly unlikely to be modified as a result of the LWA7–A10 Modification.

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

The LWA7–A10 Modification Area does not contain any areas of critical habitat, and there are no known areas of critical habitat within the local area which could be affected by the LWA7–A10 Modification.

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 LWA7–A10 Modification. However, the LWA7–A10 Modification 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 is one KTP most relevant to the LWA7–A10 Modification, being 'Alterations due to subsidence associated with longwall mining'. Given that the predicted surface impacts of the LWA7–A10 Modification will be very minor, the implication of this KTP are not constraining, however this would need to be continually reviewed and managed as mining progresses.

While the establishment of the Project will involve the operation of a KTP, the impacts of this are not regarded to be significant in relation to loss of habitat for regent honeyeater (*Anthochaera phrygia*).

Conclusion

It is considered unlikely that the LWA7–A10 Modification would result in a significant impact on regent honeyeater (*Anthochaera phrygia*) as no direct clearing will occur as a result of the LWA7–A10 Modification and subsidence related impacts are not anticipated to impact vegetation or habitats.

APPENDIX F

Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999*

Appendix F – Assessment of Significance under the *Environment Protection and Biodiversity Conservation Act 1999*

An assessment of the potential impacts of the Project is provided below for each listed Matter of National Environmental Significance (MNES) with potential to be impacted by the LWA7–A10 Modification (**Appendix B**).

MNES known to occur within the LWA7–A10 Modification Area and with potential to be impacted by the Project included the following listed vulnerable species:

Vulnerable Species

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

The following endangered species were considered to have potential to occur and were considered unlikely to be significantly impacted by the LWA7-A10 Modification; however due to their level of threat and sensitivity to environmental change full Assessments of Significance were undertaken.

Endangered Species

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

Assessment of Significance – Vulnerable Species

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

- Heath wrinklewort (*Rutidosis heterogama*); and
- Small-flower grevillea (*Grevillea parviflora* subsp*. parviflora*).

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*) have both been recorded within the LWA7–A10 Modification Area. According to the above definitions the above species are not considered to form important populations within the LWA7–A10 Modification Area.

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 LWA7–A10 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 LWA7–A10 Modification 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 LWA7–A10 Modification Area. As such, there is no potential for the LWA7–A10 Modification 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 LWA7–A10 Modification 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 LWA7–A10 Modification 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 LWA7–A10 Modification 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 LWA7–A10 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 LWA7–A10 Modification.

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

The LWA7–A10 Modification 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 LWA7–A10 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 LWA7–A10 Modification 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 LWA7–A10 Modification Area. As such, there is no potential for the LWA7–A10 Modification 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 LWA7–A10 Modification 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 species.

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

The LWA7–A10 Modification 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 LWA7–A10 Modification will not interfere with the recovery of either species.

Assessment of Significance – Endangered Species

The following EPBC Act-listed endangered species is considered in this assessment:

- swift parrot (*Lathamus discolor*) and
- regent honeyeater (*Anthochaera phrygia*) (also listed as a migratory 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*) have not been recorded in the LWA7–A10 Modification Area or in the Stage 3 Mining 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 (*Lathamus discolor*) 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 likely that there is a loose Hunter population also, with records of the species breeding at a location to the east of the LWA7–A10 Modification Area. As such, any records of the regent honeyeater (*Anthochaera phrygia*) within the LWA7–A10 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 LWA7–A10 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 LWA7–A10 Modification Area as part of a wider foraging range at appropriate times of the year. The LWA7–A10 Modification 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 LWA7–A10 Modification 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 LWA7–A10 Modification Area, however it does support potential habitat for both species. Given that surface impacts will be minor, the LWA7–A10

Modification 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 LWA7–A10 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 LWA7–A10 Modification Area. The LWA7–A10 Modification Area is not known to support any areas of critical habitat for either species. The LWA7–A10 Modification 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 LWA7–A10 Modification Area, however there is no known breeding habitat for the regent honeyeater (*Anthochaera phrygia*) and no potential breeding habitat for the swift parrot (*Lathamus discolor*) (given that they only breed in Tasmania). The LWA7–A10 Modification does not involve any clearing of habitats or fragmentation of habitats. As such, the LWA7–A10 Modification 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 LWA7–A10 Modification Area, in particular within the Lower Hunter Spotted Gum – Ironbark Forest community. The LWA7–A10 Modification is underground and will result in minor surface disturbances that are not expected to alter the habitats of the two endangered species. Consequently, the LWA7–A10 Modification 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 LWA7–A10 Modification 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 LWA7–A10 Modification 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*), and will not interfere with the recovery of either species.