APPENDIX 5

Ecological Assessment

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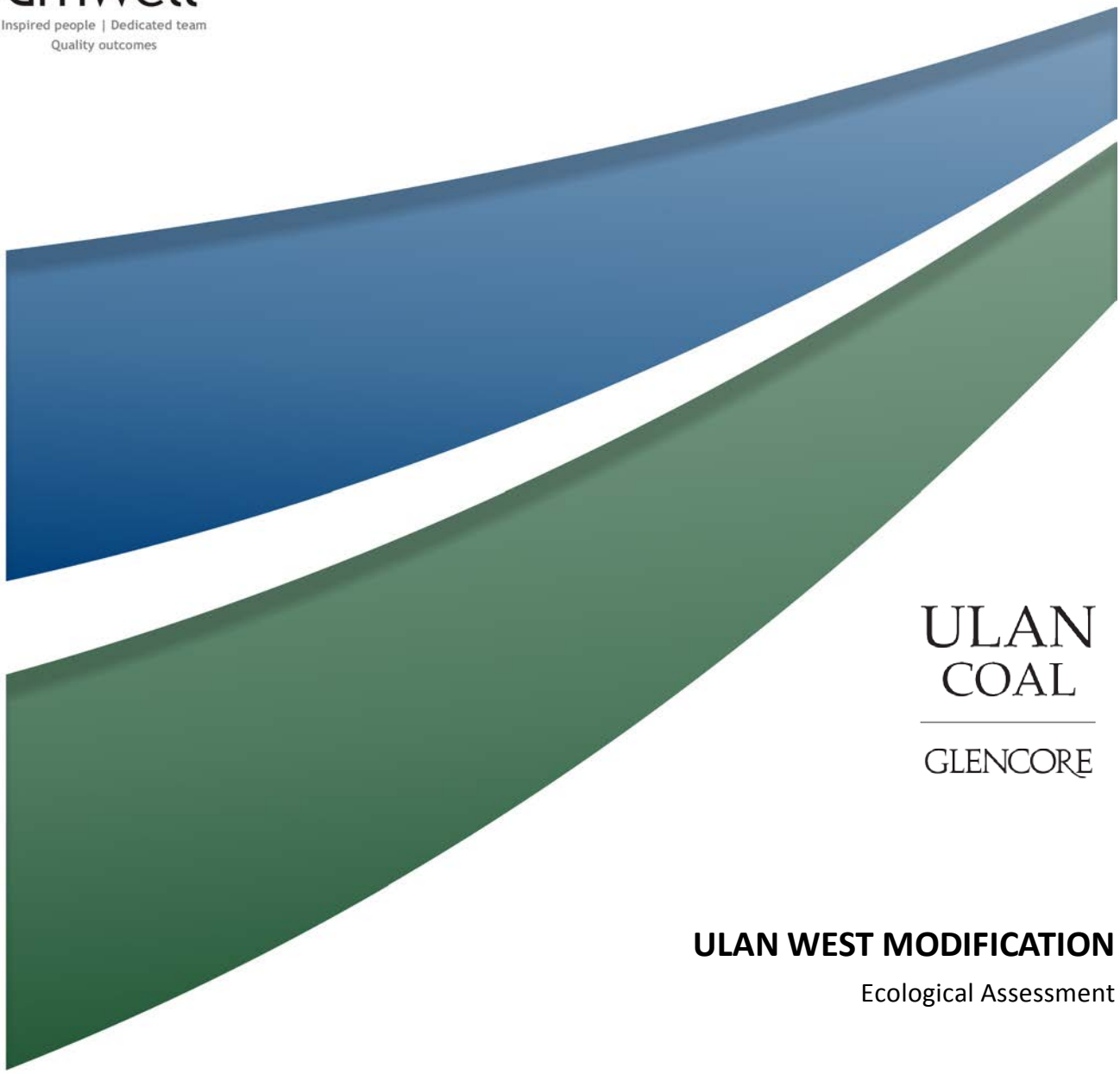

ULAN
COAL

GLENCORE

ULAN WEST MODIFICATION

Ecological Assessment

February 2015

ULAN COAL

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Ecological Assessment

[Status]

February 2015

Prepared by
Umwelt (Australia) Pty Limited

on behalf of
Glencore

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Report No.	**3363/R04/Final**
Date:	**February 2015**

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1.0 Introduction

Ulan Coal Mines Limited (UCML) is a joint venture between Glencore Coal Assets Australia Pty Limited (Glencore) (90 per cent) and Mitsubishi Development (10 per cent). Operations at the Ulan Coal Complex are located approximately 1.5 kilometres east of the village of Ulan and entirely within the Mid-Western Regional Council Local Government Area (LGA). The Ulan Coal Complex is located approximately 38 kilometres north-north-east of Mudgee and 19 kilometres north-east of Gulgong in New South Wales (refer to **Figure 1.1**).

UCML was granted Project Approval (PA) 08_0184 under Part 3A of the EP&A Act on 15 November 2010 for the Ulan Coal – Continued Operations Project (UCCO Project). UCML is seeking to modify the approved Ulan West underground operations mine plan (refer to **Figure 1.2**) to provide access to additional coal resources within an existing exploration lease and allow for a realignment of approved longwall panels as a result of previous modifications. The proposed modification is being sought under Section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

Umwelt (Australia) Pty Limited (Umwelt) has prepared this Ecological Assessment on behalf of UCML to assess the potential ecological impacts of the proposed modification to the Ulan West mine plan, including associated changes to surface infrastructure (proposed modification).

1.1 Environmental Setting and Land Use

The Ulan Coal Complex is located in the Mid Western Regional Council LGA, with the village of Ulan located 1.5 kilometres west of the existing Coal Handling and Preparation Plant (CHPP). The key features of the region surrounding the Ulan Coal Complex are illustrated in **Figure 1.3**.

The western boundary of Goulburn River National Park lies approximately 2.2 kilometres east of the Ulan Coal Complex. This reserve covers approximately 71,000 hectares stretching roughly 70 kilometres east from Ulan to Sandy Hollow. Munghorn Gap Nature Reserve covers approximately 6800 hectares and lies 20 kilometres to the south-east of the Ulan Coal Complex. The western boundary of Wollemi National Park lies approximately 50 kilometres to the south-east of the Ulan Coal Complex and the reserve occupies approximately 500,000 hectares.

The location of the conservation areas in relation to the Ulan Coal Complex is shown on **Figure 1.3**, and this includes areas of Crown reserve and State Conservation Areas (SCAs) which contribute to the connectivity of conservation reserves and forested areas within the region.

The topography of the Ulan Coal Complex is a combination of undulating valley floor to steeper slopes and rocky escarpments. This is typical of the landforms evident in the western uplands of the Great Dividing Range.

The Ulan Coal Complex straddles the Great Dividing Range and is located at the headwaters of the Goulburn River system (which drains to the east to the Hunter River catchment) and the Talbragar River system (which drains to the west to the Macquarie River catchment). Ulan West is located within the catchments of Cockabutta Creek, Mona Creek and Ulan Creek.

The landforms surrounding the Ulan Coal Complex can be characterised into three broad groups; broad valleys, transitional rocky uplands, and areas of elevation. The broad valleys

FIGURE 1.1

Locality Map

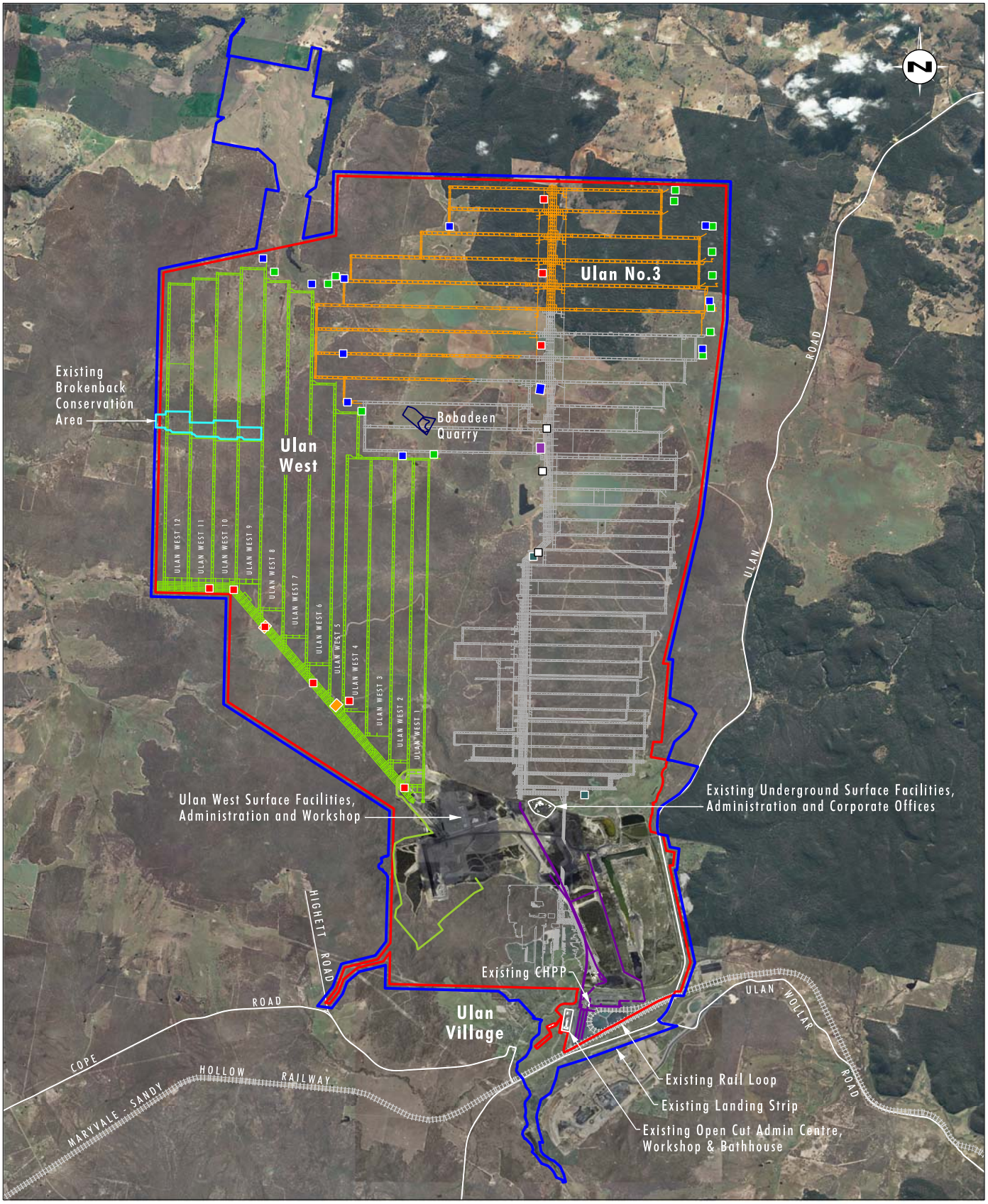

Image Source: Ulan Coal (2008, 2010, 2012, 2014)
Data Source: Ulan Coal (2013)

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Legend

- Existing Colliery Holding Boundary
- UCML Continued Operations Project Approval Area
- Approved Open Cut Extension
- Existing Brokenback Conservation Area
- Bobadeen Quarry
- Approved Ulan West Mine Plan
- Approved Ulan No.3 Underground Mine Plan
- Previous Underground Mining Operations
- Conveyors
- Approved Upcast Ventilation Shaft
- Approved Downcast Ventilation Shaft
- Approved Service Borehole Facility
- Approved Man Riding Shaft
- Approved Dewatering Bore
- Existing Ventilation Shaft
- Existing Service Borehole

FIGURE 1.2

Approved Ulan Complex Operations

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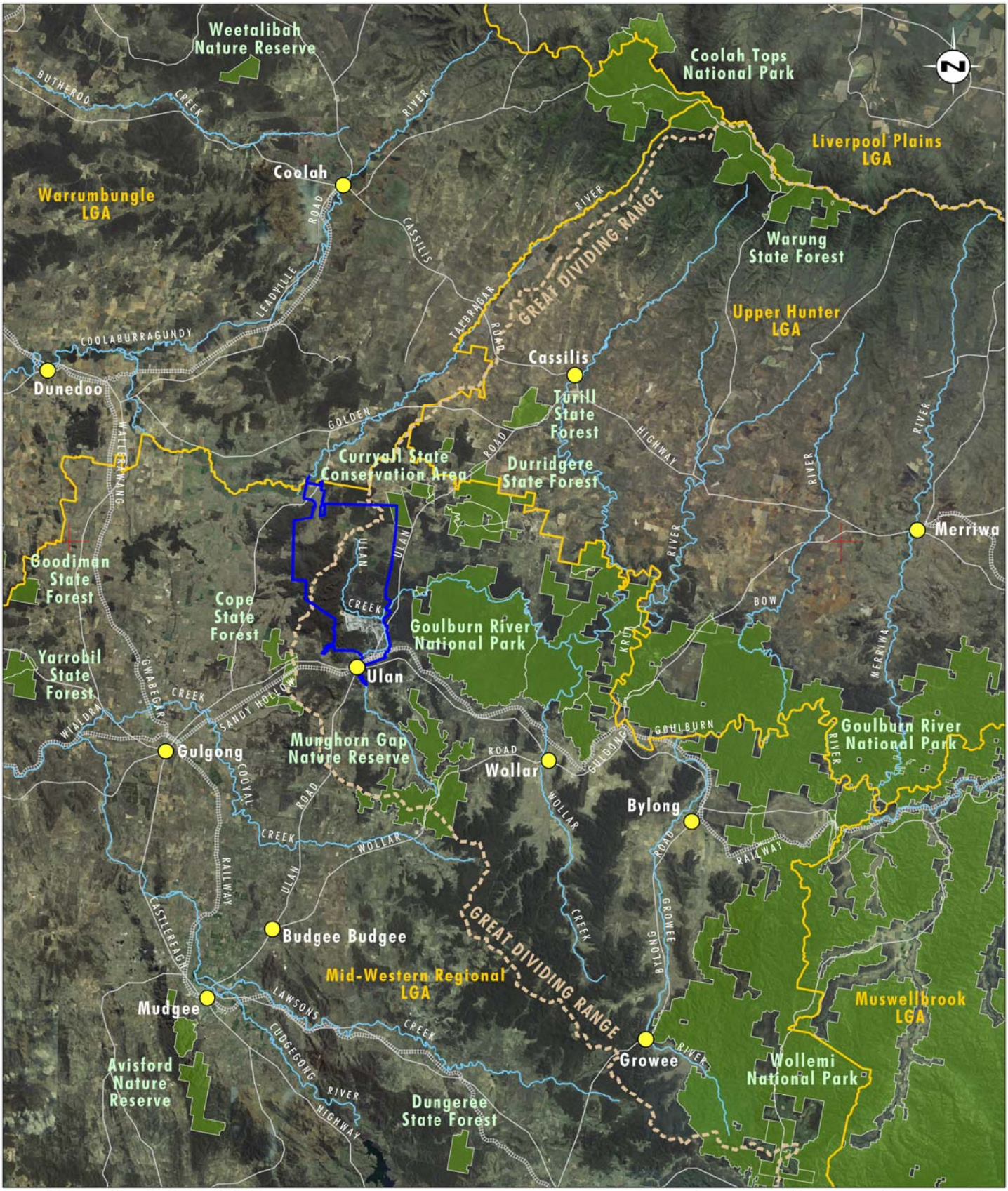

Image Source: Google Earth (2009)
Data Source: Department of Lands (2003)

Legend

- UCML Continued Operations Project Approval Area
- Conservation Reserves
- Local Government Boundary
- Rivers and Creeks

FIGURE 1.3

Regional Features Surrounding the Ulan Coal Complex

in this area have been almost entirely cleared for agricultural activity. This is typical of the landforms evident in the eastern uplands of the Great Dividing Range.

Above the Ulan West underground mining area, the landforms consist of both transitional rocky uplands and areas of elevation. Both areas have had significantly less vegetation clearance than the broad valleys; however historical logging has occurred in both landform areas.

The Ulan Coal Complex is situated in a rural area, primarily surrounded by rural landholdings, native bushland and primary industries including agriculture, forestry, mining and other extractive industries. The area to the south and south-west is dominated by rural residential landholdings. Grazing is widespread throughout the surrounding area. The land within the Ulan Coal Complex is dominated by remnant vegetation, with some cleared areas.

The land capability of the Ulan Coal Complex is of low to moderate grazing lands with varying soil quality, depth/rockiness and erosion hazard. Better quality soils are found on land in the Bobadeen region, which relates to the predominately cleared alluvial areas in the central northern part of the Ulan Coal Complex (refer to **Figure 1.2**).

The Talbragar River alluvial floodplains are approximately 3 kilometres to the north-west of Ulan Coal Complex northern mining boundary, and these are used for intensive cropping. This area is mapped as Biophysical Strategic Agricultural Land (BSAL) under the NSW Government's Strategic Regional Land Use Policy (DP&I 2012), however, is not located within the approved or proposed Ulan West underground mining area. Cropping activities are also undertaken throughout the area to the north-east of the Ulan Coal Complex from the Golden Highway to Ulan Road.

1.2 Objectives of the Ecological Assessment

This Ecological Assessment has been prepared to provide information about the potential impacts of the proposed modification on threatened and migratory species, endangered populations, threatened ecological communities (TECs) and their habitats. For the purpose of this Ecological Assessment, the term TEC has been adopted as a collective reference to the various categories of State and Commonwealth listed ecological communities (being, in this case, endangered ecological communities (EECs) and critically endangered ecological communities (CEECs)).

Terrestrial vegetation communities, flora and fauna species and fauna habitat present in the proposed modification areas have been identified and considered as part of the impact assessment. The assessment addresses potential impacts on any threatened or migratory species, endangered population, TEC, or their habitat that may occur in, or in the general vicinity of, the proposed modification. The threatened species, endangered populations, TECs, and their habitats identified within the Ulan Coal Complex as part of the UCCO Project Ecological Assessment (Umwelt 2009a) have been considered as part of this Ecological Assessment, as have results from a number of other relevant ecological studies of the Ulan Coal Complex (refer to **Section 3.1**).

This Ecological Assessment addresses the actual and potential impacts of the proposed modification, being the potential impacts relating to the construction of the proposed surface infrastructure and potential subsidence-related impacts as a result of the proposed modification to the Ulan West underground mine plan for Longwalls 5 to 12. The objectives of this Ecological Assessment are to:

- record the flora and fauna species assemblages within the proposed modification areas (being the Proposed Surface Infrastructure Area and the modified Ulan West Maximum Subsidence Affectation Area);

- identify any threatened or migratory species, endangered populations, TECs, or their habitats within the proposed modification areas, particularly those listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act), NSW *Fisheries Management Act 1994* (FM Act), and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);

- assess the potential impact of the proposed modification on threatened or migratory species, endangered populations, TECs, or their habitats recorded (or with potential to occur) in the proposed modification areas;

- provide management options to minimise ecological impacts associated with the proposed modification;

- provide recommendations on any offsetting required for residual unavoidable significant impacts to threatened or migratory species, endangered populations, TECs, or their habitats recorded (or with potential to occur) in the proposed modification areas; and

- assess the performance of the proposed modification against the overall goal to maintain or improve the biodiversity values of the surrounding region in the medium to long term. As per previous impact assessments, medium term is defined as mine closure.

This Ecological Assessment accompanies the broader Environmental Assessment (EA) prepared by Umwelt for the proposed modification. This Ecological Assessment should be read in conjunction with that document, as well as the UCCO Project Ecological Assessment (Umwelt 2009a) (where necessary), which gives full detail on the ecological features and impacts of the broader Ulan Coal Complex.

1.3 Context of Other Contemporary Ecological Studies at the Ulan Coal Complex

Biodiversity Monitoring Services (BMS) was commissioned by UCML to survey and describe the fauna species and habitat values of the proposed modification areas, and this was documented in *Fauna Surveys of part of the Southern Extension Area at Ulan Coal Mine – Modification 3* dated March 2014 (Biodiversity Monitoring Services 2014). This report has been used to inform this Ecological Assessment in relation to fauna surveys completed for the proposed modification, fauna species recorded (including threatened fauna) and descriptions of fauna habitat types within the proposed modification areas. The BMS (2014) report has been provided as **Appendix A** to this Ecological Assessment, however relevant components have been summarised within this Ecological Assessment, as appropriate.

2.0 Description of Proposed Modification

2.1 Description of Existing and Approved Operations

PA 08_0184 provides for continued underground and open cut mining activities at the Ulan Coal Complex for a period of 21 years through to August 2031. The approved operations at Ulan Coal Complex and major associated infrastructure are shown on **Figure 1.2** and consist of Ulan West underground mine, Ulan No.3 underground mine, open cut mining operations and associated surface operations.

Approved on-site facilities associated with the existing Ulan Coal Complex mining operations include:

- underground mine accesses;
- CHPP and other coal processing infrastructure such as crushers and sizing stations;
- ROM and product coal stockpiles;
- train loading facilities and rail refuelling facility;
- overland and underground conveyors;
- tailings emplacement areas;
- mine ventilation infrastructure;
- service and distribution boreholes;
- administration buildings;
- workshops and stores;
- office facilities and bathhouses;
- bulk fuel and oil storage areas;
- a basalt quarry;
- various water management structures and works, including dewatering facilities, water storages, pipelines, the Bobadeen Irrigation Scheme and water treatment plants;
- power supply infrastructure;
- communications infrastructure and monitoring equipment; and
- access roads and other minor infrastructure.

As part of the ongoing development of underground mining at Ulan West there is a range of approved surface infrastructure, some of which is yet to be constructed, including:

- upcast ventilation shafts;
- downcast ventilation shafts;

- service borehole locations, one of which is co-located with a upcast ventilation shaft; and
- infrastructure corridors which allow for services including powerlines and access roads.

Approved surface infrastructure associated with Ulan West is shown on **Figure 1.2**.

2.2 Description of Proposed Modification

Since the approval of PA 08_0184 in 2010, exploration activities have more accurately mapped the location of a geological fault that was previously interpreted as a constraint to mining in the southern portion of exploration lease (EL) 7542. This exploration has determined that the feature lies further south than previously interpreted leading UCML to determine that there is a viable resource within this area that can be efficiently accessed through a change to the existing Ulan West mine plan. A mining lease application (MLA475) has been lodged for the southern portion of the EL 7542 with the NSW Trade and Investment – Division of Resources and Energy (DRE).

UCML is proposing to modify PA 08_0184 to allow for mine plan changes to Ulan West to ensure efficient and optimised extraction of the coal resource. The proposed modification includes extension of seven longwall mining panels in order to access additional resources, realignment of longwall panels to accommodate for previous modifications and changes to the associated surface infrastructure (primarily ventilation configuration) (refer to **Figure 2.1**). In order to accommodate these proposed changes, the main headings need to be turned after longwall LW 5 (refer to **Figure 2.1**).

During 2013, UCML was granted approval by DP&E under the provisions of Condition 25 of PA 08_0184 and by the DRE to undertake first workings to widen longwall panels LW 3 and LW 4 from 300 metres to 400 metres wide. The proposed modification includes the repositioning of longwall panels LW 5 to LW12 which is required as a result of the previous changes to LW 3 and LW 4, as shown on **Figure 2.1**. The proposed repositioning to the west for LW 5 to LW 12 will generally be within the existing mining footprint and present minimal change to approved environmental impacts.

The proposed modification will produce approximately an additional 13 million tonnes of ROM coal and extend the life of the Ulan Coal Complex by approximately 2 years. The currently approved Ulan West mining area covers approximately 3,060 hectares. The proposed modification will extend this by approximately 275 hectares. The key components of the proposed modification are outlined in **Table 2.1**.

Table 2.1 – Proposed Ulan West Modification

Aspect	Currently Approved	Proposed Modification
Mine Life	21 year life until 30 August 2031	Additional 2 years until 30 August 2033
Limits on Extraction	20 million tonnes of coal per annum (including maximum of 4.1 Mtpa ROM from Open Cut)	No change
Operating Hours	24 hours per day, 7 days per week	No change
Workforce Numbers	Approximately 931 people (Complex)	No change

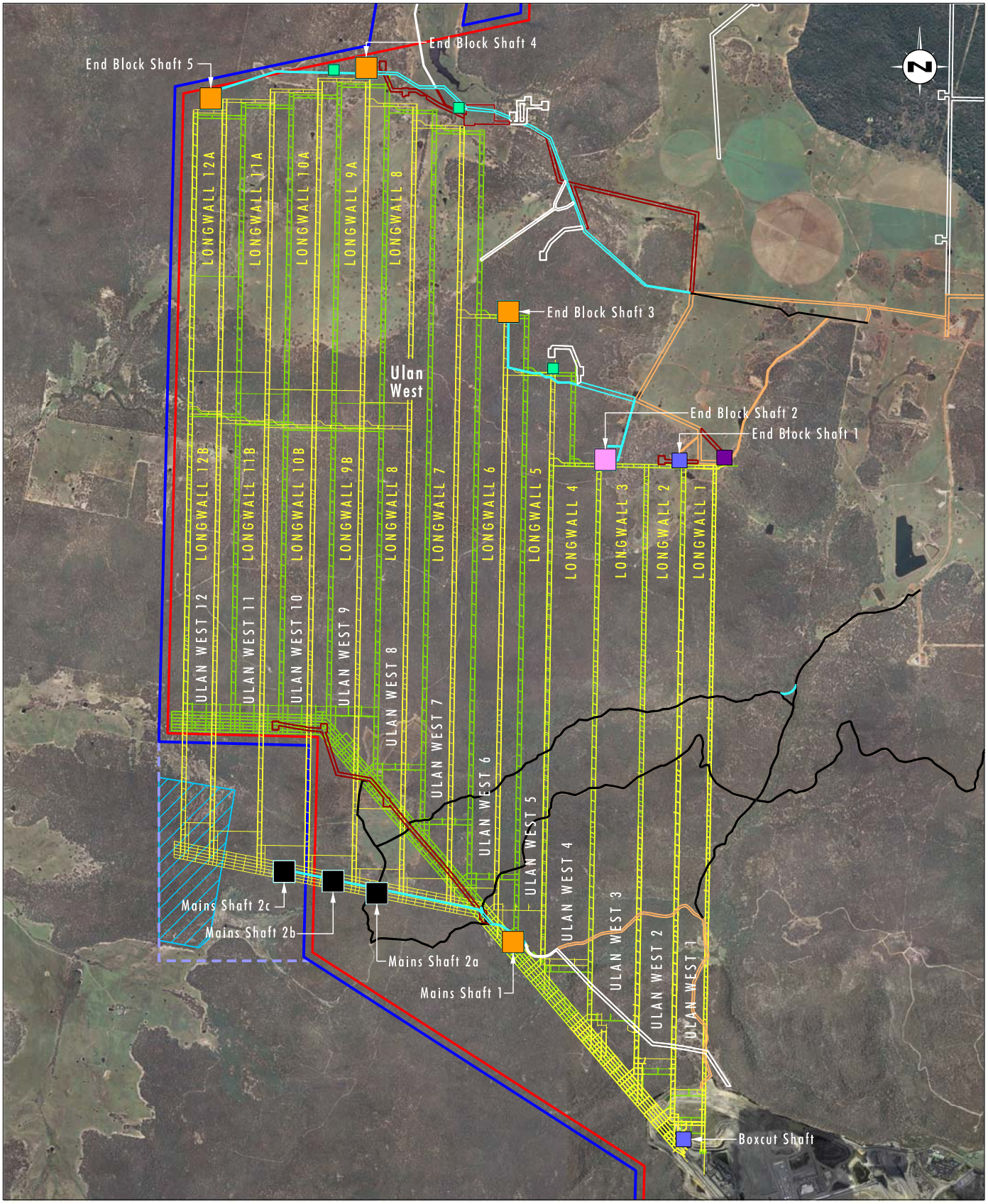

Image Source: Ulan Coal (2008, 2010, 2014)
Data Source: Ulan Coal (2014)

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Legend

- Existing Colliery Holding Boundary
- UCML Continued Operations Project Approval Area
- MLA 475
- Approved Ulan West Mine Plan
- Proposed Conceptual Ulan West Mine Plan
- Approved Infrastructure Corridor
- Approved Infrastructure Corridor Not to be Constructed
- Proposed Infrastructure Corridor
- Constructed Infrastructure Corridor
- Existing Access Road
- Existing Vent Shaft Compound
- Existing Dewatering Bore Compound
- Proposed Realigned Dewatering Bore Compound
- Proposed New Ventilation Shaft Compound
- Proposed Realigned Ventilation Shaft Compound
- Potential Location of Realigned Ventilation Shaft Compound
- Access for Survey not available

FIGURE 2.1

Proposed Ulan West Modification

Table 2.1 – Proposed Ulan West Modification (cont)

Aspect	Currently Approved	Proposed Modification
Mine Plan	As shown in **Figure 1.2**	Realignment of LW 5 to LW 12 including a reduction of LW 5 by approximately 170 metres and an extension of LW 6 to LW 12 between 900 and 1300 metres as shown in **Figure 2.1**
Mining Method	Ulan West – retreat longwall method	No change
Surface Infrastructure	As per Continued Operations Project EA	Changes to Ulan West infrastructure including repositioning of approved dewatering bores and ventilation shafts, and additional shafts and associated infrastructure for Ulan West mine plan
Ulan Coal Complex Coal Handling and Preparation Plant	As per Continued Operations Project EA	No change
Coal Transportation	All coal transported from the site by rail. No more than 10 laden trains leave the site each day.	No change
Brokenback Conservation Area	As shown on **Figure 1.2**	No change

Further details of the proposed modification being sought are outlined below.

2.2.1 Ulan West Mine Plan

UCML is proposing to modify the Ulan West mine plan to reduce the length of LW 5 by approximately 170 metres, and reposition and extend LW 6 to LW 12 by between 900 and 1300 metres (refer to **Figure 2.1**). This will require the main headings to be turned after LW 5. The proposed modification will increase the Ulan West mining area by approximately 275 hectares.

The proposed modification will not result in any additional impact on Brokenback Conservation Area. The conservation values of the area, including cliff lines that contain rockshelters that are significant from a cultural heritage perspective and significant habitat for cave dwelling bats are protected.

The proposed modification will produce approximately an additional 13 million tonnes of ROM coal and extend the life of the Ulan Coal Complex by approximately 2 years.

2.2.2 Surface Infrastructure

As a result of the proposed changes to the mine plan, the location of approved ventilation and dewatering infrastructure will need to be modified to align with the proposed changes to the main headings and longwall locations. In addition, an additional ventilation shaft will be required in order to safely operate Ulan West and this has been included as part of the proposed modification.

There are currently seven ventilation shafts, five service boreholes and four dewatering boreholes approved for Ulan West (refer to **Figure 1.2**). Approved ventilation shafts, service boreholes and dewatering boreholes yet to be constructed will require relocation as part of the proposed changes to the Ulan West Mine plan. The proposed modification includes the

installation of an additional one ventilation shaft to service Ulan West based on the review of ventilation requirements (refer to **Figure 2.1**). There will be no change to constructed ventilation shafts, service boreholes and dewatering boreholes.

There are currently five service boreholes and three upcast ventilation shafts approved for Ulan West (refer to **Figure 1.2**). The proposed modification will not require any additional ventilation shafts in the southern portion of Ulan West, rather realignment of two ventilation shafts that are yet to be constructed. One ventilation shaft is to be constructed at the southern end of LW 5, while there are three potential locations for the remaining ventilation shaft (refer to **Figure 2.1**). The final location of the third ventilation shaft will be dependent on ventilation requirements as Ulan West progresses. Service boreholes would be co-located with the proposed ventilation shafts where practicable to minimise surface disturbance.

There are currently four downcast ventilation shafts approved at the northern end of the longwalls in Ulan West (refer to **Figure 1.2**). One ventilation shaft has been constructed at the northern end of LW 2 to support the current Ulan West operations. The proposed modification will require the remaining three ventilation shafts to be relocated to service the proposed realigned longwall panels as well as an additional ventilation shaft (refer to **Figure 2.1**). The conceptual locations of the ventilation shafts are presented in **Figure 2.1**. UCML has designed the ventilation infrastructure to avoid significant environmental features, where practicable, including TECs and Aboriginal archaeological sites.

Construction of the proposed Ulan West ventilation shafts will require a construction footprint of approximately 200 metres by 200 metres. The shafts will be progressively decommissioned following completion of each longwall. Upon decommissioning, the disturbance footprint will be rehabilitated in accordance with the Ulan Coal Complex's approved rehabilitation strategies as provided in the Ulan Coal Complex Integrated Mining Operations Plan (IMOP) and Biodiversity Management Plan (BMP).

There are four dewatering bores currently approved for Ulan West (refer to **Figure 1.2**). One dewatering bore has been constructed, however the remaining three will be relocated to accommodate the change to the Ulan West mine plan. The footprint of the dewatering bores is likely to be approximately 100 metres by 100 metres during construction. The operational footprint of the ventilation shaft is likely to be smaller, once construction activities have been rehabilitated.

Supporting infrastructure is required for both construction and operation of ventilation infrastructure in Ulan West, and will include:

- access tracks;
- water supply; and
- electricity transmission lines.

This infrastructure will be located within the previously approved disturbance footprint and/or will be co-located to reduce additional disturbance, where possible (refer to **Figure 2.1**).

An infrastructure corridor is currently approved to align with the approved Ulan West main headings. The proposed modification will result in the Ulan West main headings being turned after LW 5. As a result, the infrastructure corridor will need to be realigned to service the location of the modified main headings (refer to **Figure 2.1**). The proposed infrastructure corridors have been designed to consolidate and minimise impact footprints where practicable. Minor refinement of these locations may be required during the detailed design phase of the proposed modification. Where surface infrastructure is required to be moved as a result of the detailed design process, it will be relocated to ensure that the impacts

associated with the final design and location are not significantly greater or different than that associated with the conceptual locations.

The proposed surface infrastructure has been designed to avoid impact as much as feasible. Alteration to the originally proposed layout of the Proposed Surface Infrastructure Area was undertaken in order to avoid areas of White Box Woodland TEC. This was completed in a number of phases throughout the project design phase, with infrastructure overlain on vegetation mapping and where possible, infrastructure moved to avoid areas of White Box Woodland TEC. Priority was placed on avoiding the treed variants of White Box Woodland TEC where possible, with impact focused on grassland variants where impact to the TEC was unavoidable in certain areas.

2.2.3 Proposed Modification Areas

As a result of the proposed modification detailed above, this Ecological Assessment will focus on the potential direct and indirect impacts resulting from the proposed modification areas, these being defined as:

- **Proposed Surface Infrastructure Area** - defines the total estimated footprint of all conceptual surface infrastructure locations required to be constructed to service the proposed changes to the longwall layout. This includes ventilation shafts, dewatering bores, dewatering stations and a corridor to accommodate required ancillary infrastructure (refer to **Figure 2.1**). The Proposed Surface Infrastructure Area includes infrastructure approved under PA 08_0184 however not yet constructed – thus requiring relocation as a result of the proposed changes to the Ulan West mine plan. The Proposed Surface Infrastructure Area covers up to approximately 71.0 hectares in total.

- **Maximum Subsidence Affectation Area** – this being the area where detailed modelling has identified the maximum area which has the potential to be impacted by subsidence for the modified mine plans. This includes areas that were not identified as subsidence-affected as part of the approved Ulan West mine plan, however are now included as a result of the extension of the longwalls to the south. The Maximum Subsidence Affectation Area covers a total of 3285.0 hectares.

It is noted that there are no changes proposed to LW 1 to LW 4 as part of the proposed modification. This Ecological Assessment however has included LW 1 to LW 4 within the modified Maximum Subsidence Affectation Area for completeness. Accordingly, some areas subject to this assessment have been undermined under PA 08_0184.

3.0 Project Methodology

Due to the large amount of existing ecological data relating to the Ulan Coal Complex, as well as the relatively small size of the proposed modification areas, the survey methodology adopted for the proposed modification focused initially on literature reviews and database searches. This information was then used to design a field survey program to ground-truth and refine existing vegetation mapping, and to complete targeted surveys for threatened and migratory species, endangered populations, TECs, or their habitats across the proposed modification areas. This methodology took into account all relevant existing ecological data gained as part of the UCCO Project Ecological Assessment (Umwelt 2009a), as well as relevant subsequent surveys such as those completed by BMS (2014).

3.1 Literature Review

3.1.1 Previous Studies

The long history of mining in the Ulan area has led to a large literature base relating to the area, with available relevant reports documenting mining activities in the area dating to at least the 1980s. The literature review for the UCCO Project Ecological Assessment (Umwelt 2009a) involved the consideration of a number of ecological-based documents, including site-specific surveys completed within the open cut and underground areas; surveys and monitoring completed within the larger Ulan Coal Complex; and further surveys completed outside of the Ulan Coal Complex, in surrounding areas. These reports include:

- Fly by Night (2009) The Status of Target Cave-roosting Micro-chiropteran Bats in the Ulan Approved Project Area. A report to Umwelt Australia Pty Ltd;
- Mount King Ecological Surveys (2008) Analysis of Fauna Survey Data from Ulan Coal Mine;
- Fly by Night (2008a) Survey of the Bat Fauna of Rehabilitation Areas of Ulan Open Cut Coal Mine during 2008. A report to Ulan Underground Coal Mine;
- Fly by Night (2008b) Survey of the Bat Fauna of Salinity Offset Areas, North of Bobadeen Loop, Ulan Mine 2008;
- Ecovision (2008) Ecological Impact Assessment, Prepared for Moolarben Coal Project Stage 2;
- Fly by Night (2007) Monitoring of the Bat Fauna of Ulan Underground Coal Mine Lease during 2007. A report to Ulan Underground Coal Mine;
- Moolarben Biota (2006). Flora, Fauna and Aquatic Ecology Assessment, Prepared for Moolarben Coal Project.
- Resource Strategies (2005a, b and c) Wilpinjong Coal Project Environmental Impact Statement;
- Gingra Ecological Surveys (2004, 2005) Biodiversity Monitoring – Vegetation Survey Reports;

- Other Gingra Flora Data (1997 – 2009); and
- Integrated Site Planning & Management (1996) Environmental Impact Statement – Proposed Sandstone Extraction Ulan.

A summary of these reports and findings can be found in the UCCO Project Ecological Assessment (Umwelt 2009a). All significant ecological features identified as part of these previous studies and potentially relevant to the proposed modification, have been included in the current assessment.

The following sections summarise relevant information from the UCCO Project Ecological Assessment (Umwelt 2009a) and other relevant reports completed since that time.

3.1.2 Ulan Coal – Continued Operations Ecological Assessment (Umwelt 2009a)

Umwelt was engaged by UCML to produce an Ecological Assessment for the continued operations of the mine, that included an extension of the open cut, as well as concurrently mining the approved Ulan No. 3 underground and approved Ulan West areas under a modified mine plan. The UCCO Project Ecological Assessment (Umwelt 2009a) involved extensive flora and fauna surveys and an assessment of the impact of these operations on the ecological features of the area.

Detailed methods employed as part of this assessment focused on the identification of threatened flora and fauna species, endangered populations, TECs or their habitats, and included:

- systematic plot-based flora sampling;
- extensive targeted threatened flora survey transects;
- non-quantitative survey (rapid vegetation assessment points) to assist in the delineation of vegetation communities and refinement of vegetation mapping;
- fauna trapping (including use of terrestrial Elliot A and B traps, arboreal Elliot B traps, terrestrial cage traps, harp traps and pitfall traps);
- hair tubes/funnels (terrestrial and arboreal);
- spotlighting (walking and from vehicle);
- call playback (diurnal and nocturnal);
- reptile and amphibian searches (diurnal and nocturnal);
- bird searches;
- signs of presence searches; and
- micro-bat echolocation calls (using Anabat II bat detectors).

Habitat assessments were also completed at a total of 35 sites across the Ulan Coal Complex. The assessment targeted potential habitat and resources for fauna species, particularly for threatened fauna species.

Surveys of aquatic habitats were completed within targeted parts of the Ulan Coal Complex, where subsidence modelling highlighted potential impacts on aquatic features. Umwelt completed aquatic surveys at 11 sites within the Ulan Coal Complex. Macro-invertebrate sampling was completed at five sites whilst aquatic vertebrate sampling occurred at three sites.

The results of the above methodology identified the presence of the following significant ecological features within the Ulan Coal Complex:

- Ausfeld's wattle (*Acacia ausfeldii*);
- *Homoranthus darwinioides*;
- hoary sunray (*Leucochrysum albicans var. tricolor*);
- White Box – Yellow Box – Blakely's Red Gum Woodland TEC;
- magpie goose (*Anseranas semipalmata*);
- blue-billed duck (*Oxyura australis*);
- black-breasted buzzard (*Hamirostra melanosternon*);
- spotted harrier (*Circus assimilis*);
- little eagle (*Hieraaetus morphnoides*);
- glossy black-cockatoo (*Calyptorhynchus lathami*);
- gang-gang cockatoo (*Callocephalon fimbriatum*);
- little lorikeet (*Glossopsitta pusilla*);
- swift parrot (*Lathamus discolor*);
- turquoise parrot (*Neophema pulchella*);
- powerful owl (*Ninox strenua*);
- barking owl (*Ninox connivens*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- black-chinned honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- painted honeyeater (*Grantiella picta*);
- scarlet robin (*Petroica boodang*);
- flame robin (*Petroica phoenicea*);
- hooded robin (south-eastern form) (*Melanodryas cucullata cucullata*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);

- varied sittella (*Daphoenositta chrysoptera*);
- white-browed woodswallow (*Artamus superciliosus*) (no longer listed under the TSC Act);
- diamond firetail (*Stagonopleura guttata*);
- koala (*Phascolarctos cinereus*);
- squirrel glider (*Petaurus norfolcensis*);
- brush-tailed rock-wallaby (*Petrogale penicillata*);
- yellow-bellied sheathtail bat (*Saccolaimus flaviventris*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- greater long-eared bat (*Nyctophilus timoriensis*), now reclassified as south-eastern long-eared bat (*Nyctophilus corbeni*);
- little pied bat (*Chalinolobus picatus*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- large-footed myotis (*Myotis adversus*), now reclassified as southern myotis (*Myotis macropus*); and
- eastern cave-bat (*Vespadelus troughtoni*).

Each of these has been considered within the current Ecological Assessment, in terms of potential presence (or habitat) within the proposed modification areas, as well as potential impact from the proposed modification.

3.1.3 Ecological Assessment – Modifications of Ulan Coal – Continued Operations – North 1 Underground Mining Area, Minor Modifications to Ulan No. 3 and Ulan West Mine Plans and Proposed Concrete Batching Plant (Umwelt 2010a)

Umwelt was engaged by UCML to prepare an Ecological Assessment of proposed modifications to Project Approval 08_0184, for the inclusion of the North 1 Underground Mining Area, minor modifications to Ulan No. 3 and the Ulan West Mine Plans as well as a proposed Concrete Batching Plant.

For the purposes of this Ecological Assessment, a comprehensive literature review was undertaken, as well as database searches, and field surveys of new areas to be impacted.

Field surveys were undertaken over four days and three nights between 25 and 28 October 2010 and targeted areas that were not subject to survey as part of previous approvals. Flora surveys had an emphasis on refinement and ground-truthing of existing vegetation mapping and included walking vegetation transects throughout the modification areas as well as five rapid assessments.

Fauna surveys comprised area searches (due to the comprehensive trapping surveys undertaken for Mount King (2008) and Umwelt (2009a), as such surveys comprised spotlighting on-foot and from a vehicle, Anabat echolocation surveys, call playback surveys and opportunistic observations and signs of presence searches undertaken throughout all aspects of surveys.

Flora field surveys did not identify additional flora species to those recorded as part of Umwelt (2009a) and did not identify any threatened flora species. A total of seven vegetation communities were identified within the modification areas, however none of these were considered to conform to a TEC listed under either the EPBC Act or TSC Act.

Fauna surveys identified 86 vertebrate fauna species comprised of 70 birds, three reptiles, two amphibians and 11 mammals. These included threatened species each listed as vulnerable under the TSC Act, being the powerful owl (*Ninox strenua*), glossy black cockatoo (*Calyptorhynchus lathami*) and the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

This Ecological Assessment identified that the modifications had the potential to result on a significant impact for the eastern bentwing bat (*Miniopterus schreibersii oceanensis*), little pied bat (*Chalinolobus picatus*), large-eared pied bat (*Chalinolobus dwyeri*), southern myotis (*Myotis macropus*), and eastern cave bat (*Vespadelus troughtoni*). However it was considered to be highly unlikely.

3.1.4 EL7542 Exploration Drill Holes – Ecological Assessment (Eco Logical 2012)

Eco Logical (ELA) was engaged by UCML to undertake a flora and fauna impact assessment for two drill sites and their associated tracks to support a Surface Disturbance Notice for the proposed EL7542 exploration project.

The project involved a review of the Office of Environment and Heritage (OEH) Atlas of Wildlife database and the EPBC Protected Matters Search Tool as well as site inspections of the drill sites and their proposed access tracks. Site inspections included a full floristic 20 metre by 20 metre survey plot at each drill site as well as a meander around a radius of approximately 30 metres surrounding the plots and the access tracks looking for significant ecological features.

The drill sites and associated access tracks were identified as occurring across four vegetation communities, these being:

- Regenerating Blakely's Red Gum Open Forest (which was consistent with White Box – Yellow Box – Blakely's Red Gum endangered ecological community (EEC) (listed under the TSC Act) and White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grasslands critically endangered ecological community (CEEC) (listed under the EPBC Act));
- Ironbark Open Forest Complex on Sandstone;
- Narrow-leaved Ironbark Alluvial Open Forest; and
- Regenerating Rough-barked Apple Alluvium Open Forest.

Significant habitat features were identified in the form of hollow-bearing trees which were demarcated to be avoided, as well as a wombat (*Vombatus ursinus*) burrow.

No threatened flora or fauna species were identified, however the following threatened fauna were considered to have potential to occur:

- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- varied sittella (*Daphoenositta chrysoptera*);
- painted honeyeater (*Grantiella picta*);
- black-chinned honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- little pied bat (*Chalinolobus picatus*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- eastern freetail bat (*Mormopterus norfolkensis*);
- south-eastern long-eared bat (*Nyctophilus corbeni*);
- yellow-bellied sheathtail bat (*Saccolaimus flaviventris*); and
- greater broad-nosed bat (*Scoteanax rueppellii*).

Impact assessment determined that the project would be unlikely to have significant impact on threatened or migratory species, endangered populations or TECs.

3.1.5 Fauna Surveys of Part of the Southern Extension Area at Ulan Coal Mine Modification 3 (Biodiversity Monitoring Services 2014)

BMS was engaged by UCML to assess fauna species with the potential to occur in the areas proposed for change as part of the Ulan West longwall layout. Works completed included a desktop review as well as a field survey component. No impact assessment was completed as part of these works as these surveys and results were to be incorporated into this Ecological Assessment for the proposed modification. The full report is provided as **Appendix A**, and relevant results and methods have been included within this Ecological Assessment, where relevant.

Surveys were completed within the proposed modification areas (where access was available at the time of survey) between 10 - 21 March 2014 and 22 - 29 June 2014. Surveys consisted of six fauna survey sites, one in the northern modification area and five in the southern modification area. Greater survey emphasis was placed on the areas of high habitat value compared to those with poor habitat value. A total of 24 person-days of survey were completed, and surveys consisted of:

- Terrestrial Elliott trapping;
- Arboreal Elliot trapping;
- Cage trapping;
- Hair funnels;
- Hair tubes;
- Pitfall traps;

- Spotlighting;
- Remote cameras;
- Harp trapping;
- Anabat surveys;
- Call playback;
- Bird area searches;
- Herpetofauna searches;
- Sand plots;
- Habitat structural analysis;
- Targeted winter bird surveys (consisting of targeted meander surveys in areas of appropriate habitat); and
- Opportunistic records (including scat, burrow, nest, scratch and track identification).

Habitats were described as being typical of the woodland and grassland habitats of the region that were sufficient to support a diversity of fauna species. The surveys identified the following threatened fauna species:

- glossy black cockatoo (*Calyptorhynchus lathami*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- black-chinned honeyeater (*Melithreptus gularis gularis*);
- scarlet robin (*Petroica boodang*);
- grey-crowned babbler (*Pomatostomus temporalis temporalis*);
- varied sittella (*Daphoenositta chrysoptera*);
- diamond firetail (*Stagonopleura guttata*);
- koala (*Phascolarctos cinereus*); and
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*).

Each of these has been considered within the current Ecological Assessment, in terms of presence (or potential habitat) within the proposed modification areas, as well as potential impact from the proposed modification.

3.1.6 Ulan Coal Mines Limited Floristic Monitoring Report 2013 (Eco Logical Australia 2014)

The 2013 annual floristic monitoring was undertaken to address the requirement for ecological monitoring and associated reporting detailed within the Ulan Coal Complex Biodiversity Management Plan (BMP). Annual floristic monitoring occurs across areas of remnant vegetation, revegetation/regeneration areas as well as within subsidence monitoring areas. During 2013 floristic monitoring was undertaken at 67 sites, 30 of these were monitored in autumn and the remaining 37 were monitored in spring. In addition, landscape function analysis monitoring was completed (at 27 sites), as well as targeted Ausfeld's wattle (*Acacia ausfeldii*) surveys (within a known population along Highett Road).

Surveys identified a total of 324 species (of which 50 (15 per cent) were introduced), with total species richness of floristic plots varying between 8 species and 49 species. The 2013 surveys did not identify any new flora species listed under the TSC Act or the EPBC Act that have not been identified previously within the Ulan Coal Complex; however did identify additional Ausfeld's wattle (Acac*ia ausfeldii*) locations in the south-west UCCO Project Boundary.

3.1.7 Ecological Monitoring Program for Ulan Coal Mine 2013 - Terrestrial Fauna and Habitats (Biodiversity Monitoring Services 2013)

The 2013 terrestrial fauna monitoring program was undertaken to assess the adequacy of the Ulan Coal Complex ecological management strategies undertaken as part of the BMP as well as the adequacy of the Operational Impact Mitigation Strategy, the Biodiversity Offset and Management Strategy and the 2009 EA.

The 2013 terrestrial fauna monitoring excluded surveys for bat species and occurred at a total of 22 sites. Surveys were undertaken across autumn, winter and spring and consisted of habitat assessment, Elliott trapping, cage trapping, spot-lighting, hair funnels, glider traps, remote cameras, bird surveys, call playback, reptile and amphibian searches, pit-fall trapping, targeted brush-tailed rock wallaby (*Petrogale penicillata*) searches, animal track/sign recognition and opportunistic observation.

Terrestrial fauna surveys identified 12 amphibians, 18 reptiles, 22 mammals (11 introduced) and 143 birds (one introduced) across all monitoring sites. This included nine threatened species being the square-tailed kite (*Lophoictinia isura*), glossy black cockatoo (*Calyptorhynchus lathami*), little lorikeet (*Glossopsitta pusilla*), brown treecreeper (*Climacteris picumnus*), speckled warbler (*Chthonicola sagittata*), painted honeyeater (*Grantiella picta*), scarlet robin (*Petroica boodang*), grey-crowned babbler (south-eastern subspecies) (*Pomatostomus temporalis temporalis*) and varied sittella (*Daphoenositta chrysoptera*). All are listed as vulnerable under the TSC Act.

3.1.8 Cliff Line Impact Monitoring at Ulan (Eco Logical Australia 2013b)

Eco Logical Australia (ELA) undertook pre and post-mining monitoring of cliff lines within the Ulan Coal Complex North 1 mining area (longwall panels C, E and F) for evidence of mine subsidence related impacts (ELA 2013). UCML were committed to no more than 20 per cent of the total cliff length within the North 1 mining area experiencing mining-induced cliff fall, consequently, the purpose of this monitoring was to compare predictions from the impact assessment (Umwelt 2011) to actual on-ground changes.

Monitoring undertaken included establishment of permanent transects in the North 1 mining area as well as in control sites (i.e. areas not proposed to be mined) in order to quantify lengths of pre-mining (in 2011) rock fall (recent versus weathered) for later comparison.

Transects were then re-visited 16 months (in 2013) later for post-mining monitoring data collection. Data collected included field observations and panoramic photographic records.

Results of monitoring indicated 60 metres of rock fall had occurred within the North 1 mining area that was considered a direct result of mining. This was based on monitoring of control sites which experienced negligible rock fall. The 60 metres equates to 6.0 percent of the total length of cliff line within the North 1 mining area, which was much less than the subsidence impact performance measure of 20 per cent. It is anticipated that similar mining-induced subsidence will result from the proposed modification.

Recommendations of ELA (2013) indicated that future cliff line monitoring works should include field validation of areas of cliff line in comparison to sandstone outcrops to ensure that relevant areas are included in monitoring transects. This reflects the limitations of the cliff line modelling (completed as part of the 2009 EA), whereby the height analysis applied to the DTM to identify cliff line areas was not able to differentiate between steep outcrops/slopes versus actual cliff lines. This limitation has resulted in a consistent overestimation of the length of cliff lines present (and thus cliff line impacts) across all impact assessments.

3.1.9 Micro-bat Impact Monitoring at Ulan – Fly By Night (2008 – 2014)

Targeted monitoring of micro-bats has occurred on a regular basis within the UCCO Project Area since 1994 (most recently these included the works of Fly By Night 2008a, 2008b, 2009a, 2009b, 2010a, 2010b, 2011a, 2011b, 2012a, 2012b, 2013, 2014a, and 2014b). These monitoring works have been undertaken across the Ulan Coal Complex, Salinity Offset Areas (Bobadeen), Brokenback Conservation Area, Spring Gully Cliff Line Management Area, Rehabilitation Areas of Ulan Open Cut, North 1 Longwall panels (pre-mining) and Ulan West (first three longwall panels prior to underground mining).

Monitoring has occurred seasonally during periods where the highest potential for activity and breeding are anticipated to occur, with methods consistently applied and including Anabat echolocation recording, harp trapping, radio-tracking (where opportunities to do so were identified), and physical inspections of roosting and breeding sites (where accessible).

Significant records identified throughout this monitoring have been the:

- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- south-eastern long-eared bat (*Nyctophilus corbeni*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- yellow-bellied sheathtail bat (*Saccolaimus flaviventris*);
- little pied bat (*Chalinolobus picatus*); and
- greater broad-nosed bat (*Scoteanax rueppellii*).

All of these species are listed as vulnerable under the TSC Act with the large-eared pied-bat (*Chalinolobus dwyeri*) and south-eastern long-eared bat (*Nyctophilus corbeni*) also listed as vulnerable under the EPBC Act.

Three cave-dependant species that are regularly recorded throughout the Ulan Coal Complex and are considered potentially vulnerable to underground mining impacts are the large-eared pied bat (*Chalinolobus dwyeri*) (including two confirmed and one highly likely

maternity roost), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) and eastern horseshoe bat (*Rhinolophus megaphyllus*) (although not threatened is locally significant). Each of these is a target species for monitoring works.

These large amounts of monitoring data from rehabilitation areas, non-disturbed remnant vegetation and underground mining areas (with emphasis on micro-bat and cliff line monitoring prior to and following subsidence) have identified the following trends:

- Negligible micro-bat diversity is present in recently revegetated areas; however by five years is reaching half the recorded diversity of nearby remnant forested areas. With the areas of the oldest rehabilitation at the Ulan Coal Complex (established in approximately 1991) approaching diversity of nearby remnant forested areas.

- Most micro-bats identified in rehabilitation areas were considered likely to be foraging within rehabilitation and roosting within nearby mature vegetation (however one species had been identified roosting under decorticating bark of a dead Acacia in a rehabilitated area).

Based on the monitoring completed thus far, Fly By Night (2013) has not identified any evidence of micro-bat species being impacted by subsidence within the Ulan Coal Complex, and indicates that populations of the three target cave-roosting species appear to be stable (Fly By Night 2014b). However, this program recommends continued monitoring to gain further data on post-subsidence status of target cave-dependent species as well as to distinguish subsidence induced to naturally occurring fluctuations.

3.1.10 Occurrence of *Pomaderris queenslandica* (Scant Pomaderris) at Ulan Coal Mine – Strip 12 (Eco Logical Australia 2014)

This document reports on a detailed survey of a population of scant pomaderris (*Pomaderris queenslandica*) identified while completing pre-clearing surveys of the Strip 12 open cut extension in the Ulan Coal Mine. This species is listed as endangered under the TSC Act, however is not listed under the EPBC Act.

Three ‘aggregations’ of this species were recorded in area to the south of the open cut extension, to the east of Goanna Road. In total, 95 mature plants and 84 seedlings/suckers were recorded.

Rapid surveys were completed within the Brokenback, Bobadeen and Spring Gully offset areas within the Ulan Mine to determine if this species (or its habitat) was present in these offset areas. Local habitat for this species was defined as steep sandstone escarpments within woodland dominated by a variety of eucalypt species. Six ‘aggregations’ were recorded from Spring Gully, comprising 4 mature plants and 53 seedlings/suckers.

A variety of mitigation measures and recommendations were provided to minimise impact to this species.

3.1.11 Ecological Database Searches

In order to identify all potential threatened and migratory species, endangered populations, and TECs with the potential to occur in the proposed modification areas, a detailed assessment of relevant ecological databases was completed. These database sources comprised:

- a 10 kilometre radius search from the centre of the proposed modification areas from the NSW BioNet – the website for the Atlas of NSW Wildlife – maintained by OEH (as of July 2014);

- DoE Protected Matters Search Tool Results for a 10 kilometre radius search from the centre of the proposed modification areas (July 2014); and

- the results of the detailed database searches completed as part of the UCCO Project Ecological Assessment (Umwelt 2009a), including use of the above, as well as the (then) Birds Australia, Australian Museum and Royal Botanic Gardens databases.

Searches of both the NSW BioNet and the DoE Protected Matters Search Tool were completed throughout the reporting process. These results were incorporated into the consideration of the likelihood for these features to occur within the proposed modification areas, as well as the broader Ulan Coal Complex.

Records from these database searches were combined with records from a number of other sources to develop a list of potentially occurring threatened species, endangered populations and TECs (**Appendix B**). Also included in this list were relevant records from the literature review, previous field surveys and professional opinion. Furthermore, a number of additional species that are not listed under the TSC Act were included, such as species listed under the EPBC Act and rare or threatened Australian plant (ROTAP) species (as per Briggs & Leigh 1996) considered likely to have potential habitat within the proposed modification areas.

3.2 Field Survey

3.2.1 Survey Timing

A comprehensive field survey program was completed within the Ulan Coal Complex as part of the UCCO Project Ecological Assessment (Umwelt 2009a), as well as part of ongoing ecological monitoring and subsequent modification projects. The high level of ecological knowledge gained as part of these previous (and ongoing) projects has provided a detailed level of data on the ecological features of the proposed modification areas, as well as the larger Ulan Coal Complex.

The additional field survey completed as part of this Ecological Assessment was concentrated within the proposed modification areas, specifically within the south-west and north-west corners (refer to **Figure 3.1**). This figure includes only flora-based surveys, the fauna surveys completed for this proposed modification are provided in **Appendix 1**.

Field surveys have occurred over a number of seasons and years, and across the Ulan Coal Complex. **Table 3.1** provides details on the various flora survey periods completed by Umwelt in the Ulan Coal Complex and proposed modification areas. All surveys have been completed by two suitably qualified ecologists.

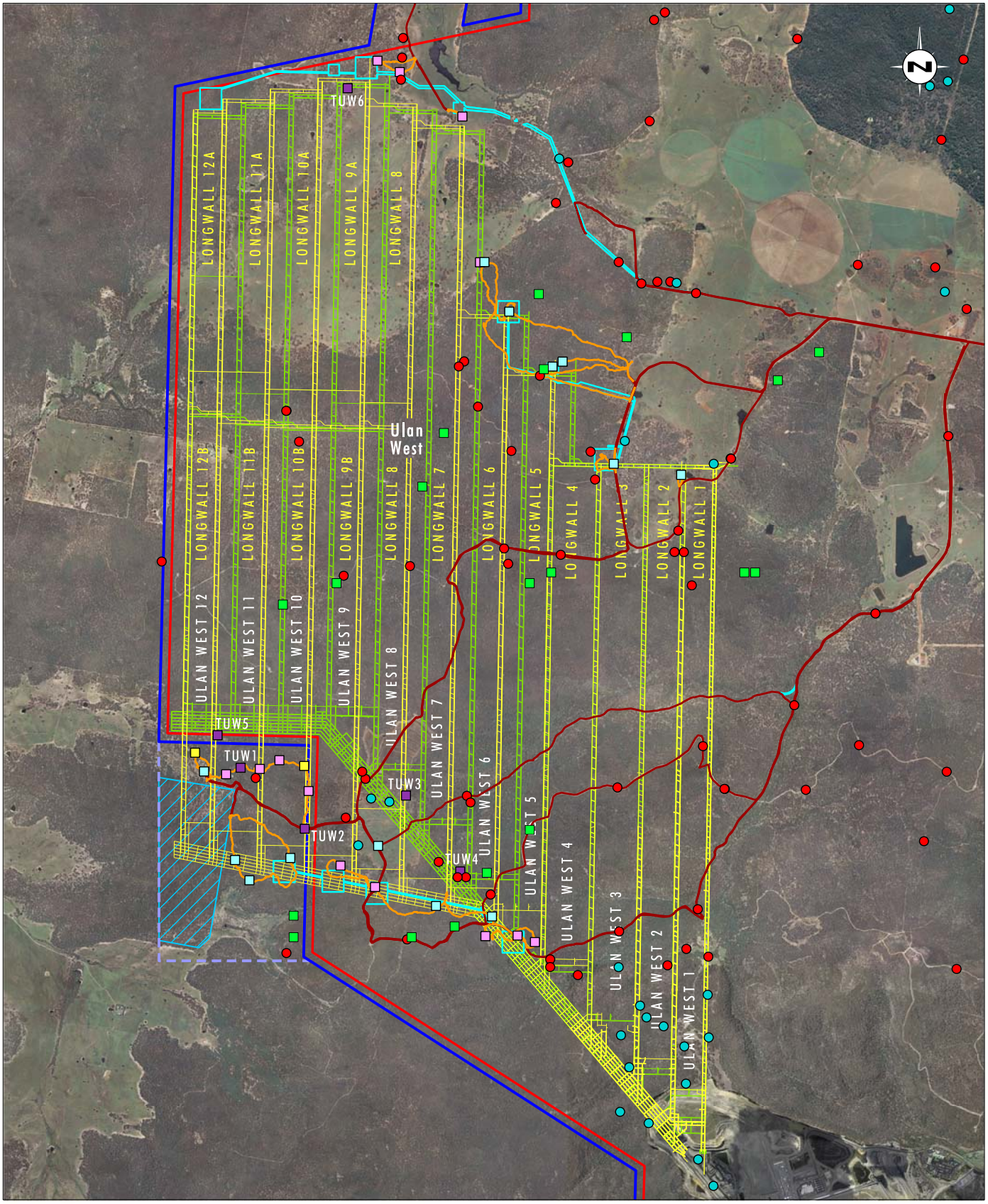

Image Source: Ulan Coal (2008, 2010, 2014)
Data Source: Ulan Coal (2014), Biodiversity Monitoring Services (2014), Umwelt (2009 and 2014)

0 1.0 2.0 2.5km
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Legend

- Existing Colliery Holding Boundary
- UCML Continued Operations Project Approval Area
- MLA 475
- Approved Ulan West Mine Plan
- Proposed Conceptual Ulan West Mine Plan
- Proposed Surface Infrastructure Area
- Travelling Vegetation Transect
- Walking Vegetation Transect
- Floristic Plot (2014)
- Qualitative Rapid Assessments (2014)
- Semi-quantitative Rapid Sampling Plots (2014)
- Fauna Survey Sites (2014)
- Qualitative Rapid Assessment (2009)
- Floristic Plot (2009)
- Gingra Survey Point (2009)
- Access for Survey not available

FIGURE 3.1

Targeted Field Survey Effort

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20141211 9.30

Table 3.1 – Flora Survey Timing for Ulan Coal Complex

Survey Area	Season	Year	Dates	Length
Ulan Coal Complex - Open Cut Disturbance Area				
Open Cut Disturbance Area	Spring	2006	11 – 12 September	4 person days
	Autumn	2006	28 – 31 September	8 person days
North of Open Cut Disturbance Area	Autumn	2006	28 – 31 March	8 person days
	Spring	2006	13 – 14 September	4 person days
South of Open Cut Disturbance Area	Winter	2007	6 – 8 August	6 person days
	Spring	2007	22 – 25 October	8 person days
Ulan Coal Complex				
Initial Broad Vegetation Mapping	Spring	2007	10 – 12 September 3 – 5 October	6 person days 6 person days
Surface Infrastructure Disturbance Areas	Spring	2008	September 15 - 20	10 person days
	Spring	2008	September 29 – October 2	8 person days
Vegetation ground-truthing Surveys	Autumn	2008	15 – 18 April	8 person days
	Spring	2008	3 – 7 November	10 person days
Ulan Coal Complex - Proposed Ulan North 1 Modification Areas				
Vegetation ground-truthing Surveys	Spring	2010	25 – 28 October	8 person days
Proposed Modification Areas				
Vegetation ground-truthing Surveys	Winter	2014	24 – 27 June	8 person days

In total, 102 ten-hour person-days have been completed by Umwelt to comprehensively sample the vegetation communities and flora species across the Ulan Coal Complex, including the proposed modification areas.

3.2.2 Flora Survey Methods

A comprehensive and detailed vegetation map was produced as part of the UCCO Project Ecological Assessment (Umwelt 2009a). This vegetation map was completed in two stages; initial broad vegetation mapping and then refinement and finalisation of vegetation mapping based on extensive ground-truthing. Both stages drew upon information gained from aerial photography interpretation (API) and targeted survey effort which incorporated non-quantitative and quantitative methods.

The flora surveys completed for the proposed modification aimed to ground-truth existing vegetation mapping from the UCCO Project Ecological Assessment (Umwelt 2009a), identify threatened species, endangered populations, TECs and species of local or regional significance occurring or considered to potentially occur within the proposed modification areas.

Surveys focused on quantitative, semi-quantitative and qualitative ground-truthing of existing vegetation mapping (Umwelt 2009a) and targeted threatened flora searches, and were

completed in accordance with the DECCW Draft Threatened Species Survey and Assessment Guidelines (DECC 2004), where appropriate. The aims of the flora field surveys were to:

- ground-truth existing vegetation mapping for the proposed modification areas (from Umwelt 2009a), and update the mapping where appropriate;
- describe the general health and condition of the vegetation of the proposed modification areas;
- determine if any threatened flora species, endangered populations or TECs were present or have potential to occur within the proposed modification areas; and
- gather sufficient information to enable an accurate assessment of the impacts of the project on the flora values of the proposed modification areas.

Figure 3.1 identifies the location of the flora surveys completed within the proposed modification areas. This includes previous field surveys (including Umwelt 2009a) that relate to these areas.

3.2.2.1 Floristic Plots

A total of 59 floristic plots were conducted in the field surveys conducted as part of the UCCO Project Ecological Assessment (Umwelt 2009a). Two additional floristic plots were completed during the field survey of the proposed modification areas, in areas where further data was required to strengthen community definition and boundaries. The combined total of 61 floristic quadrats that have been conducted within the wider UCCO Project Area is shown on **Figure 3.1**.

At each plot, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 metre plot. Searches of each 20 x 20 metre plot were generally completed through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of the shrub, mid-storey, canopy and emergent layers were also thoroughly examined. Effort was made to search the tree canopy and tree trunks for mistletoes, vines and epiphytes.

Species within the plot were also assigned a cover-abundance value to reflect their relative cover and abundance in the plot. Species located outside the plot (recorded to assist in vegetation community identifications and mapping) were marked as present but were not assigned a cover-abundance value. A modified Braun-Blanquet 6-point scale (Braun-Blanquet 1927, with selected modifications sourced from Poore 1955 and Austin *et al.* 2000) was used to estimate cover-abundances of all plant species within each 20 x 20 metre plot. **Table 3.2** shows the cover-abundance categories used.

Table 3.2 – Modified Braun-Blanquet Crown Cover-abundance Scale

Class	Cover-abundance*	Notes
1	Few individuals (less than 5% cover)	Herbs, sedges and grasses: <5 individuals Shrubs and small trees: <5 individuals
2	Many individuals (less than 5% cover)	Herbs, 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	–

Table 3.2 – Modified Braun-Blanquet Crown Cover-abundance Scale (cont)

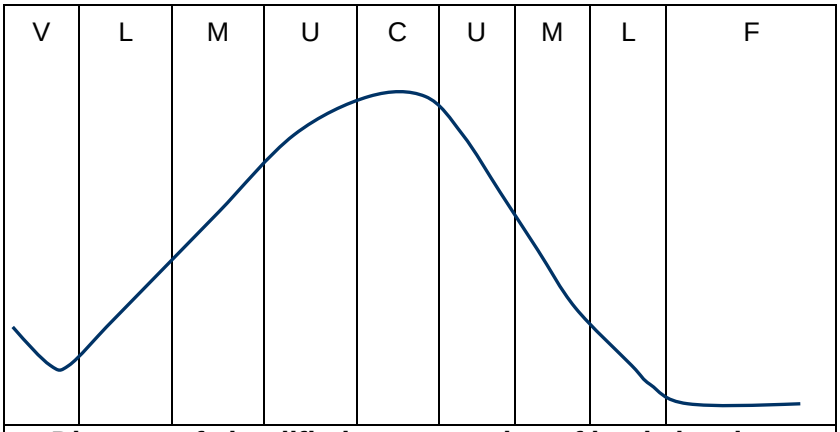
Class	Cover-abundance*	Notes
4	20 – less than 50% cover	–
5	50 – less than 75% cover	–
6	75 – 100% cover	–

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

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

In addition, information was gathered on the condition of the vegetation at each of the survey sites, including fire history and the density of weeds and evidence of disturbance such as feral animals.

The locations of the plots were selected by considering a range of attributes that were considered to influence or determine the type of vegetation communities present. This stratification was done intuitively, but based on existing topographic, soil and vegetation. Other factors considered included the spacing of sites, as well as topographic position (refer to **Schematic 3.1** below) and aspect.



Schematic 3.1 – Topographic Positions

Photographic records were taken at each plot from the north-east corner looking along the short side of the plot, diagonally along the plot and then along the long side of the plot.

3.2.2.2 Vegetation Transects

Walking vegetation transects were traversed throughout the proposed modification areas. The objectives of these transects were to:

- search for threatened flora species and endangered flora populations, including their habitats;
- assist in the ground-truthing of vegetation communities, including TECs;
- enable greater coverage of the proposed modification areas than would be achieved by plot-based sampling; and
- contribute to the floristic knowledge of the proposed modification areas.

The walking transects were variable in length and location, and were tailored to suit each proposed modification area, as well as the environment in which they occurred. The location of the walking transects completed within the proposed modification areas is provided on **Figure 3.1**.

3.2.2.3 Semi-quantitative Rapid Assessments

A total of 13 semi-quantitative rapid assessments of approximately 20 x 20 metres were used to obtain further information about the vegetation in the proposed modification areas without the need to complete systematic plot surveys at those points (refer to **Figure 3.1**). Approximately 15 to 20 minutes were spent searching for vascular plants occurring within each 400 m^2 rapid sampling plots. Vegetation structure was also recorded at each semi-quantitative rapid sampling plot. Semi-quantitative rapid assessments assisted with the delineation and refinement of vegetation community boundaries.

3.2.2.4 Qualitative Rapid Assessments

A total of 13 qualitative rapid assessments were completed across the proposed modification area, with a further 116 rapid assessments conducted as part of the UCCO Project Ecological Assessment (Umwelt 2009a). The location of these assessment points are provided in **Figure 3.1**.

Each of the qualitative rapid assessments completed as part of the current study comprised the recording of the dominant canopy, understorey and groundcover species as well as notes on the condition of the vegetation in each of these strata around the qualitative rapid assessment site. The qualitative rapid assessments utilised a qualitative sampling approach, as this method was designed to allow rapid collection of non-quantitative species dominance data across the proposed modification area within limited timeframes. The data from the qualitative rapid assessments was primarily used to provide assistance in the delineation and refinement of vegetation mapping.

A part of qualitative rapid assessments completed for Umwelt (2009a), dominant, common and some uncommon plant taxa were recorded within each vegetation community along meandering transects, carried out on foot, at each location. A meandering technique was selected instead of the plot-based method because it increased the amount of data that could be collected within the available survey time, thereby maximising the quality and coverage of vegetation description and mapping. The relative abundance of vascular plants recorded during qualitative rapid assessments completed for Umwelt (2009) was determined using a four-point scoring system as shown in **Table 3.3**.

Table 3.3 - Relative Cover-Abundance Scoring System used in Qualitative Rapid Assessments completed for Umwelt (2009a)

Relative Abundance in Vegetation Community	Field code	Numerical Code (for data entry)
Dominant	D	4
Common	C	3
Localised patches (not dominant)	L	2
Occasional and uncommon	O	1

3.2.2.5 Plant Identification and Taxonomic Review

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 & 2002) and Wheeler *et al.* (2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from *PlantNET* (Botanic Gardens Trust 2014), the online plant name database maintained by the National Herbarium of New South Wales.

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

3.2.3 Fauna Survey Methods

Fauna surveys were carried out to identify the fauna species and their habitats occurring in the proposed modification areas, including threatened and migratory species, endangered populations and species of local and regional significance. Fauna field surveys were completed by BMS (2014) across two different survey periods and seasons with a wide range of methodologies employed. In addition to this Umwelt undertook opportunistic records within the proposed modification areas while undertaking flora surveys. As such the fauna methodology has been divided into works completed by Umwelt and works completed by BMS.

3.2.3.1 Biodiversity Monitoring Services (2014) Fauna Surveys

Surveys completed by BMS (2014) comprised four detailed survey sites and two observational sites completed between 10 and 21 March 2014; and winter bird surveys completed between 22 and 29 June 2014. One of the observational sites was located in the Northern Modification Area (TUW6), with the second observational site and four detailed survey sites located in the Southern Modification Area (TUW5, TUW1, TUW2, TUW3 and TUW4). Locations of all survey sites are provided in **Figure 3.1**.

Table 3.4 below provides a summary of the 2014 fauna survey effort completed by BMS at each of the six survey sites.

Table 3.4 – Fauna Survey completed by Biodiversity Monitoring Services (2014)

Site	GE	TE	LE	Cage	Hair	GT	Pit	Spot	Cam	Harp	Ana	Cal1	Cal2	Hab	BP	BA	Opp	Sca1	Sca2	Herp	Sc	Sp	VE	BN	AT	DD
TUW1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TUW2	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TUW3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TUW4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TUW5								X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
TUW6								X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Key to fauna survey effort:

GE : Ground Elliots
TE : Tree-mounted Elliots
LE : Large Elliots
Cage : Cage Traps
Hair : Hair Funnels
GT : Glider Tubes
Pit : Pitfall Traps
Spot : Spotlighting Transects
Cam : Remote Camera Traps
Ana : Anabat Call recording
Cal1 : Marsupial Call playback
Cal2 : Nocturnal Bird calls
Hab : Habitat Structure Analysis
BP : Bird Point Count
BA : Bird Area Count
Opp : Opportunistic Sightings
Sca1 : Scat Recognition
Sca2 : Scat Analysis
Herp : Reptile and Amphibian Searches
Sc : Scratch Recognition
Sp : Sand Plots
VE : Visual encounter
BN : Burrow and Nest Recognition
AT : Animal Track Recognition
DD : Direct Observation

Winter bird surveys completed by BMS targeted the regent honeyeater (*Anthochaera phrygia*) (listed as critically endangered under the TSC Act and endangered under the EPBC Act) and swift parrot (*Lathamus discolor*) (listed as endangered under both the TSC Act and EPBC Act).

These surveys comprised initially identifying likely areas of habitat (based on vegetation composition) and then traversing these areas searching for winter birds. Each winter bird survey was completed by two people walking in opposite directions for a 30 minute period.

3.2.3.2 Umwelt Fauna Surveys

The main components of the fauna survey completed by Umwelt in 2014 consisted of a literature review, database searches and opportunistic field survey. The process for literature review and database searches is described in **Section 3.1**, while the components of the field survey are detailed further below.

The aim of the fauna surveys was to identify threatened species or their habitats occurring (or considered to have the potential to occur) within the proposed modification areas.

No targeted area searches were completed by Umwelt for the current study; however any threatened species opportunistically recorded during flora surveys were recorded. Fauna-based area searches were completed while walking transects for threatened flora searches and vegetation mapping were completed.

3.2.3.2.1 Opportunistic Recordings

Opportunistic fauna observations were completed during the field surveys to identify bird, mammal, reptile and amphibian species that occur within and surrounding the proposed modification areas.

3.2.3.2.2 Signs of Presence Searches

Searches for signs of animal presence were conducted opportunistically during all survey activities, particularly during habitat searches and reptile and amphibian searches. Evidence of presence included scats, feathers, nests, burrows, footprints, bones, tufts of hair and scratch marks on trees.

3.2.4 State Environmental Planning Policy 44 – Koala Habitat Survey Methods

Any development application in a State Environmental Planning Policy (SEPP) 44 specified local government area, affecting an area of 1 hectare or greater, must be assessed under SEPP 44. Assessment under SEPP 44 is based on an initial determination of whether the land constitutes potential koala (*Phascolarctos cinereus*) habitat. This is determined by assessing whether the eucalypt species present in Schedule 2 of the policy constitute 15 per cent or more of the total number of trees in the upper or lower strata of the tree component. If potential koala habitat is present, the area must be further assessed to determine if the land is core koala habitat.

The species listed in Schedule 2 of the policy are listed in **Table 3.5**.

Table 3.5 – Species of Eucalypt listed in 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

Assessment of the presence of koala feed trees (as per **Table 3.5**) was made as part of the systematic flora plots undertaken for the current surveys, as well as part of Umwelt (2009a).

3.2.5 Survey Area

It is noted that a portion of the proposed modification areas was not able to be accessed for the purposes of ecological surveys. This area is identified on **Figures 2.1**, **3.1**, **4.1** and **4.2**. As a result, fauna surveys were not completed in this area however habitat descriptions were extrapolated from adjoining habitat types.

In relation to vegetation mapping, this area was subject to detailed literature review, aerial photographic interpretation (API), visual assessments of vegetation from adjoining vantage points (where possible) and extrapolation of data from adjoining communities.

The results of the vegetation mapping completed for relevant projects (within the project area, and within the local area) were used to gain an understanding of the existing vegetation patterns present across the local area. Existing vegetation mapping for the Ulan Coal Complex was also used in order to inform the mapping.

The vegetation mapping for this area is based on sufficient information and local familiarity to have an acceptable level of confidence for the purposes of this Ecological Assessment. While posing some limitation in terms of confidence in threatened species presence, the habitat assessment provides for sufficient information to consider the likelihood of occurrence of threatened species and the precautionary principle has been applied in terms of assessing potential impacts.

4.0 Results

4.1 Flora Results

4.1.1 Flora Species

A comprehensive quantitative field survey was completed as part of the UCCO Project Ecological Assessment (Umwelt 2009a); which resulted in the identification of 634 flora species. It is anticipated that many of these species occur within the proposed modification areas. The current surveys completed for the proposed modification areas resulted in the identification of a total of 191 flora species. Of these, 18 (9%) are non-native species. Plants were recorded from all four major vascular plant classes: cycads, conifers, ferns and flowering plants and included trees, tree mallees, shrubs, forbs, grasses, sedges, rushes, reeds, ferns, lithophytes, epiphytes, mistletoes, vines and twiners.

An updated flora species list including the results of the floristic plots and rapid vegetation assessments conducted during the most recent field survey of the proposed modification areas is provided within **Appendix C** of this report. The species list was updated from the original provided in the UCCO Project Ecological Assessment (Umwelt 2009a). While it is not assumed that all of these species occur within the proposed modification areas, this list provides a detailed representation of the species recorded from the local area. None of the threatened flora species recorded within the Ulan Coal Complex as part of the UCCO Project Ecological Assessment (Umwelt 2009a) were recorded within the proposed modification areas.

Seventy-six plant families were recorded (**Table 4.1**). Fabaceae was the most speciose plant family, followed by Poaceae and Asteraceae.

Table 4.1 - Composition of Plant Classes and Families Recorded

Plant class	Sub-class	Number of families	Number of species
Filicopsida (ferns)	-	2	5
Cycadopsida (cycads)	-	1	1
Coniferopsida (conifers)	-	1	2
Magnoliopsida (flowering plants)	Magnoliidae (dicots)	43	137
Magnoliopsida (flowering plants)	Liliidae (monocots)	9	46
Totals (all plants)		**56**	**191**

Table 4.2 shows the top ten most speciose families recorded.

Table 4.2 - Ten Most Speciose Plant Families Recorded

Family (Common Name)	Number of Species
Myrtaceae (eucalypts, tea trees & paperbarks)	24
Fabaceae (peas & wattles) – total	21
(Fabaceae – Faboideae)	(8)
(Fabaceae – Mimosoideae)	(13)
Asteraceae (daisies)	18

Table 4.2 - Ten Most Speciose Plant Families Recorded (cont)

Family (Common Name)	Number of Species
Poaceae (grasses)	17
Ericaceae (Styphelioideae) (heaths)	11
Orchidaceae (orchids)	8
Lomandraceae (mat-rushes)	7
Total	**106**

The most speciose genera (**Table 4.3**) were dominated by *Eucalyptus* and *Acacia*, with 14 and 13 species respectively. Shrubby growth-forms dominated the most speciose genera, ahead of grasses, forbs and trees.

Table 4.3 - Most Speciose Plant Genera Recorded

Genus (Common Name)	Number of Species
Acacia (wattles)	13
Eucalyptus (eucalypts)	14
Lomandra (mat-rushes)	7
Total Taxa	**34**

Of the plants recorded, 18 (9%) were not native to the proposed modification areas. One noxious weed species (<1% of the flora of the proposed modification areas) (as listed in the NSW Government Gazette No. 166, 23 December 2005 (New South Wales Government 2005)) was recorded in the proposed modification areas (**Table 4.4**). There are no weed species listed as a *Weed of National Significance*, (Thorp and Lynch 2000) recorded within the proposed modification areas.

Table 4.4 - Noxious Weeds Recorded

Family	Botanical Name	Common Name	Noxious Weed Control Objective
Cactaceae	**Opuntia stricta* var. *stricta*	prickly pear	4

Notes: Control objectives:

4 Minimise the negative impact of those plants on the economy, community or environment of NSW.
* Denotes introduced – not native to Australia or the proposed modification areas.

4.1.2 Vegetation Communities

A detailed vegetation map of the Ulan Coal Complex was produced for the UCCO Project Ecological Assessment (Umwelt 2009a). A total of 37 vegetation communities were delineated in this area as a result of the comprehensive field survey that was completed.

The field survey that was conducted as part of this Ecological Assessment ground-truthed the vegetation communities that were previously mapped within MLA475 (refer to **Figure 4.1**). In total 23 vegetation communities including vegetation community variants were delineated within the proposed modification areas following survey (refer to **Figure 4.1** and **Table 4.5**).

Figure 4.1 identifies each of these vegetation communities, as well as large water bodies and cleared areas devoid of vegetation. All of the mapped vegetation communities except three (Improved Pasture, Derived Native Grasslands and Unimproved Pasture are naturally-

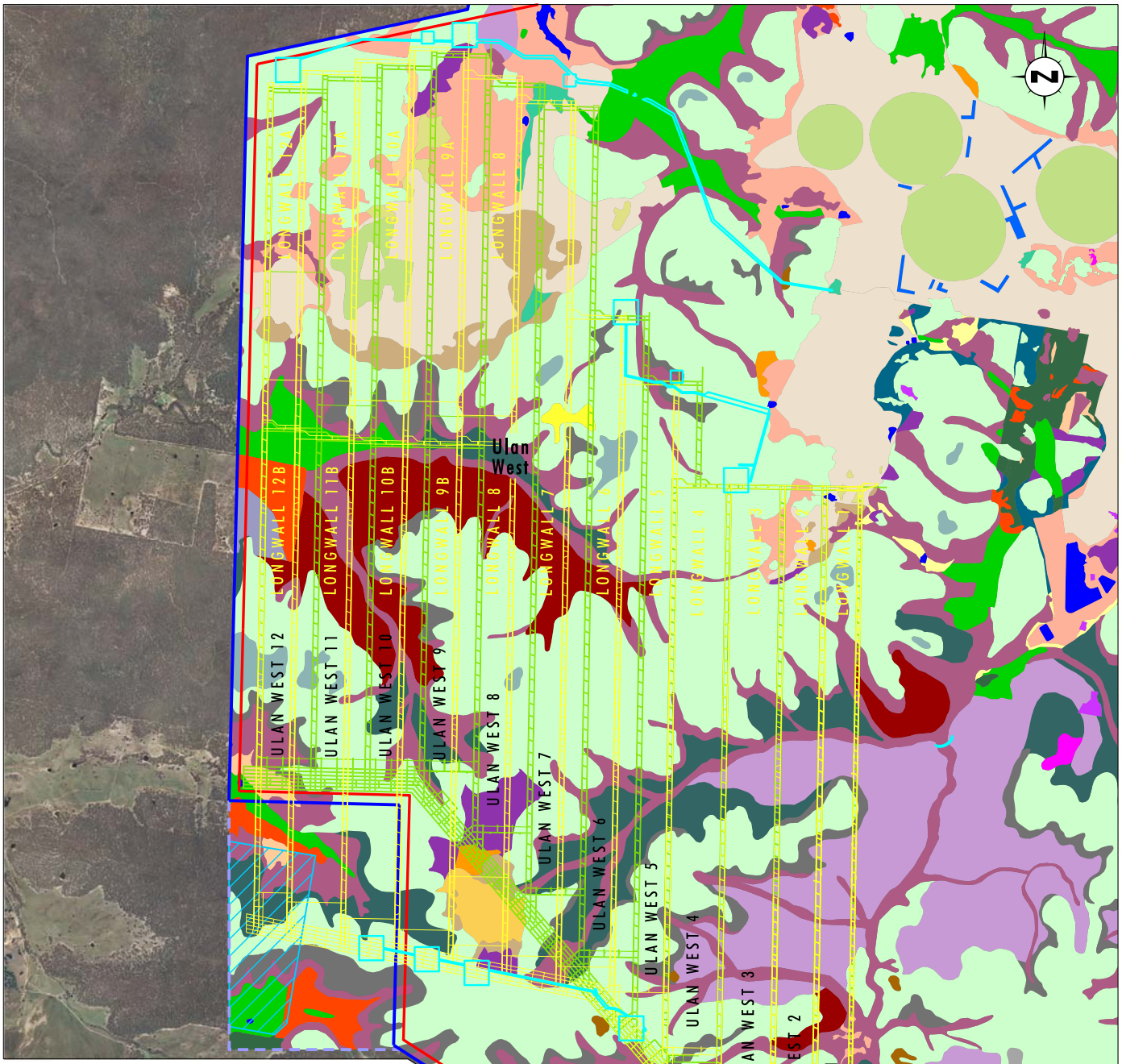


Image Source: Ulan Coal (2008, 2010, 2014)
Data Source: Ulan Coal (2014)

Legend

- Existing Colliery Holding Boundary
- UCML Continued Operations Project Approval Area
- MLA 475
- Approved Ulan West Mine Plan
- Proposed Conceptual Ulan West Mine Plan
- Proposed Surface Infrastructure Corridor
- Black Cypress Forest on Sandstone
- Blakelys Red Gum Open Forest
- Blakelys Red Gum Open Forest Grassland
- Blakelys Red Gum Open Forest (regenerating)
- Cleared Land
- Derived Native Grassland
- Dry Heathland on Rocky Outcrops
- Grey Box Woodland
- Improved Pasture
- Ironbark Open Forest Complex Grassland
- Ironbark Open Forest Complex on Sandstone
- Ironbark Open Forest Complex on Sandstone (regenerating)
- Ironbark Open Forest Complex on Sandstone & Dry Heathland on Rocky Outcrops
- Modified White Box Woodland
- Narrow-leaved Ironbark Open Forest & Scribbly Gum Woodland Heathland on Sand Plateaux
- Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium
- Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium (regenerating)
- Planted Area
- Rehabilitation Pre 1997
- Rehabilitation Post 1997
- Water Body
- White Box Woodland
- Unimproved Pasture
- White Box Woodland (regenerating)
- Yellow Box - Red Gum Woodland
- Rough-barked Apple Open Forest Grassland
- Rough-barked Apple Open Forest Alluvium/Colluvium
- Scribbly Gum Woodland Heathland on Sand Plateaux
- She-oak Low Forest on Sandstone Crests
- She-oak Low Forest on Sandstone Crests & Dry Heathland on Rocky Outcrops
- Rough-barked Apple Open Forest Alluvium/Colluvium (regenerating)
- Stringybark-Ironbark Open Forest on Sandstone Slopes
- Access for Survey not available

FIGURE 4.1

Vegetation Communities Around Proposed Ulan West Modification Areas

occurring, although most have been significantly modified during the past two centuries through extensive management, including clearing and regeneration.

Table 4.5 identifies the extent of each of these vegetation communities within the proposed modification areas, the extent is separated into those communities that occur within the Maximum Subsidence Affectation Area and those that occur within the Proposed Surface Infrastructure Area.

As described in **Section 2.2.2**, there are three potential locations being considered for one of the ventilation shafts that requires construction as part of this proposed modification. The final site for this shaft is yet to be defined, as it will be dependent on the ventilation requirements of the progressing Ulan West longwalls. In relation to direct impacts, **Table 4.5** below provides the maximum and minimum impact range for the relevant communities, taking into account the three potential locations for Main Shaft 2.

Table 4.5 - Vegetation Communities and Formations of the Proposed Modification Areas

Vegetation Community	Maximum Subsidence Affectation Area	Proposed Surface Infrastructure Area	Total
Forest/Open Forest Formation			
Blakely's Red Gum Open Forest	41.4	5.9	47.3
Blakely's Red Gum Open Forest (regenerating)	29.2	0.0	29.2
Ironbark Open Forest Complex on Sandstone	1469.2	38.61 – 38.08	1507.8
Ironbark Open Forest Complex on Sandstone (regenerating)	48.7	1.0 – 0.35	49.7
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium	225.2	0.18 – 0.14	225.4
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium (regenerating)	10.8	0.0	10.8
Rough-barked Apple Open Forest on Alluvium/Colluvium	419.9	3.7	423.6
Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating)	36.4	2.1	38.6
She-oak Low Forest on Sandstone Crests	39.4	0.0	39.4
Stringybark-Ironbark Open Forest on Sandstone Slopes	104.5	1.6	106.2
Woodland Formation			
Grey Box Woodland	5.3	0.0	5.3
Modified White Box Woodland	12.7	0.0	12.7
Scribbly Gum Woodland – Heathland on Sand Plateaux	164.0	0.7	164.7
White Box Woodland	83.2	0.0	83.2
White Box Woodland (regenerating)	25.7	0.0	25.7
Yellow Box - Red Gum Woodland	12.6	0.0	12.6
Heathland Formation			
Dry Heathland on Rocky Outcrops	0.6	0.1	0.7
Narrow-leaved Ironbark Open Forest + Scribbly Gum Woodland – Heathland on Sand Plateaux	202.8	0.0	202.8
She-oak Low Forest on Sandstone Crests + Dry Heathland on Rocky Outcrops	6.3	0.0	6.3

Table 4.5 - Vegetation Communities and Formations of the Proposed Modification Areas (cont)

Vegetation Community	Maximum Subsidence Affectation Area	Proposed Surface Infrastructure Area	Total
Grassland Formation			
Derived Native Grassland	224.6	2.5	227.1
Improved Pasture	26.7	0.0	26.7
Rough-barked Apple Open Forest Grassland	1.1	0.0	1.1
Unimproved Pasture	131.7	2.1	133.7
Cleared			
Cleared	0.6	0.0	0.6
Water Bodies			
Water Bodies	0.8	0.0	0.8
TOTAL	**3323.4**	**58.7**	**3382.2**

Note: Values have been rounded up to nearest single decimal place. All values subject to minor mapping/GIS-based discrepancies.

Most vegetation communities are widespread in the local area, while some occur much more extensively across a broader range of over 100 kilometres. Some communities, however, have a more restricted local occurrence. In general, communities occurring on Triassic conglomerate are well represented in the local area, while those restricted to riparian zones and occurring on basalt-derived soils are less well represented.

Vegetation communities were grouped into five vegetation formations for the purpose of field survey design, analysis and impact assessment, being:

- Forest/Open Forests;
- Woodlands;
- Heathland;
- Grasslands; and
- Cleared.

The majority of the mapped vegetation communities were classified into the Forest/Open Forests formation.

The following sub-sections provide the following information on each vegetation community:

- a floristic and structural description;
- the occurrence of each community in the proposed modification areas; and
- the conservation status of the community.

Detailed descriptions are provided for all of the vegetation communities identified within the proposed modification areas, however regenerating variants or highly similar variants are grouped, where relevant.

4.1.2.1 Forest/Open Forests Formation

4.1.2.1.1 Blakely's Red Gum Open Forest

Blakely's Red Gum Open Forest occurs on broad alluvial flats associated with drainage lines in the Bobadeen region. Blakely's red gum (*Eucalyptus blakelyi*) is generally the sole canopy species present, however, rough-barked apple (*Angophora floribunda*) occurs occasionally. The canopy is generally up to 18 metres in height with 20 to 30 per cent cover.

A moderately sparse shrub layer up to 2 metres in height, with 10 to 20 per cent cover, is usually present. Recorded species include sifton bush (*Cassinia arcuata*), narrow-leaved geebung (*Persoonia linearis*), *Sannantha cunninghamii*, pink spider flower (*Grevillea sericea*) and urn heath (*Melichrus urceolatus*).

The ground cover vegetation is generally moderately dense with 30 to 50 per cent cover and is dominated by native grasses and forbs. Commonly recorded species include rough saw-sedge (*Gahnia aspera*), threeawn speargrass (*Aristida vagans*), forest hedgehog grass (*Echinopogon ovatus*), early spring grass (*Eriochloa pseudoacrotricha*), stinking pennywort (*Hydrocotyle laxiflora*), small St John's wort (*Hypericum gramineum*), native cranberry (*Astroloma humifusum*), *Poranthera microphylla*, *Glycine clandestina* and *Glycine tabacina*.

A regenerating variant of this community is located in a small number of locations in the proposed Ulan West mining area where broad drainage lines have been previously cleared and grazed. The species composition of the regenerating community is broadly similar to that of the mature, intact community; however the regenerating variant is more prone to weed infestation because of its disturbance history. The canopy layer of the regenerating variant exists as regenerating trees with some scattered mature Blakely's red gum trees.

Blakely's Red Gum Open Forest occurs in the centre and south of MLA475, where broad drainage lines meet cleared areas in the Bobadeen region. Much of this community remains largely intact as the community extends up drainage lines, away from areas cleared for agricultural activities, however it is also in these areas that the community grades into Rough-barked Apple Open Forest.

Blakely's Red Gum Open Forest is also closely related to Yellow Box – Red Gum Woodland and White Box Woodland, which can occur on the slopes uphill of the community in the Bobadeen region. Some understorey species are shared between these three communities.

Blakely's Red Gum Open Forest is affiliated with Rough-barked Apple Woodland, with the two communities intergrading where the alluvium and colluvium meet at the margins of broad alluvial flats.

This community is listed as an EEC under the TSC Act and a CEEC under the EPBC Act.

4.1.2.1.2 Ironbark Open Forest Complex on Sandstone

Ironbark Open Forest Complex is typically a dry, mid-high to tall open forest-woodland, generally 10 to 18 metres tall (however only 6 metres on rocky sites), with 20 to 30 per cent cover. The community occurs on a variety of substrates ranging from sandy-loams and conglomerates to sands. Dominant canopy species include broad-leaved ironbark (*Eucalyptus fibrosa*), narrow-leaved stringybark (*E. sparsifolia*) and narrow-leaved ironbark (*E. crebra*). Other common canopy trees include blue-leaved stringybark (*E. agglomerata*), Dwyer's red gum (*E. dwyeri*), red stringybark (*E. macrorhyncha* subsp. *macrorhyncha*) and occasionally inland scribbly gum (*E. rossii*). Grey gum (*E. punctata*) is common in this community in the southern part of the proposed Ulan West mining area. Black cypress pine (*Callitris endlicheri*), narrow-leaved wattle (*Acacia linearifolia*) and *Allocasuarina gymnanthera* are widespread in the canopy and sub-canopy of Ironbark Open Forest Complex.

The understorey typically comprises a sparse to mid-dense sclerophyllous shrub stratum generally up to 2 metres in height with between 5 and 40 per cent cover, which becomes dense in small patches often on skeletal soils where trees are less dominant. Common and dominant shrubs recorded were blunt beard-heath (*Leucopogon muticus*), *L. attenuatus*, pink five-corners (*Styphelia triflora*), narrow-leaved geebung (*Persoonia linearis*), *Goodenia hederacea* subsp. *hederacea*, prickly shaggy pea (*Podolobium ilicifolium*), *Pultenaea cinerascens*, sifton bush (*Cassinia arcuata*), *C.* species D, *C. quinquefaria*, common fringe-myrtle (*Calytrix tetragona*), *Leptospermum parvifolium*, tantoon (*L. polygalifolium*), urn heath (*Melichrus urceolatus*), ruby urn heath (*M. erubescens*), *Melaleuca erubescens*, *Pultenaea laxiflora*, varnish wattle (*Acacia verniciflua*), box-leaved wattle (*Acacia buxifolia*), *Platysace ericoides* and *Harmogia densifolia*.

The ground cover is typically dry and sparse to very sparse, with generally up to 10 per cent cover. A range of forbs, ferns and grasses characterise the community including poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), *Phyllanthus hirtellus*, pomax (*Pomax umbellata*), *Hydrocotyle peduncularis*, *Pseudanthus divaricatissimus*, silky purple-flag (*Patersonia sericea*), orchids (*Caladenia* spp. and *Pterostylis* spp.), blue flax lily (*Dianella revoluta* var. *revoluta*), threeawn speargrass (*Aristida vagans*), weeping grass (*Microlaena stipoides* var.

stipoides), forest hedgehog grass (*Echinopogon ovatus*), purple burr-daisy (*Calotis cuneifolia*), *Poranthera microphylla*, *Oxalis exilis*, hairy stinkweed (*Opercularia hispida*), rough saw-sedge (*Gahnia aspera*), *Lepidosperma laterale*, wattle mat-rush (*Lomandra filiformis*), mat-rush (*L. confertifolia* subsp. *pallida*), pale mat-rush (*L. glauca*) and many-flowered mat-rush (*L. multiflora* subsp. *multiflora*).

Ironbark Open Forest Complex is closely related to Stringybark – Ironbark Open Forest, with which it intergrades, particularly in slope positions and on shallow soils with a high percentage of sandstone outcropping. Ironbark Open Forest Complex is also closely related to She Oak Low Forest, the latter of which develops in areas that are often on level, crest positions. In many cases, small stands of She Oak Low Forest occur in Ironbark Open Forest Complex that are too small to be mapped separately. Species that characterise She Oak Low Forest also commonly occur in Ironbark Open Forest Complex.

Both Black Cypress Forest and *Acacia* Forest are closely related to Ironbark Open Forest Complex. These two communities are relatively common within the Ulan Coal Complex (Umwelt, 2009a), but were not recorded within the proposed Ulan West mining area. Black cypress pine (*Callitris endlicheri*) is a common tree in the Ironbark Open Forest Complex that sometimes occurs in small, monospecific stands within the Ironbark Open Forest Complex, which are too small to be mapped separately. Similarly, narrow-leaved wattle (*Acacia linearifolia*), which is a characteristic and dominant tree in *Acacia* Forest, forms stands within Ironbark Open Forest Complex that are too small to be mapped separately as *Acacia* Forest.

Areas of sclerophyllous heath become dominant in the Ironbark Open Forest Complex where the tree stratum declines to a very sparse-absent level and, if present, are often in a mallee or stunted habit. These heaths are consistent with the Dry Heathland community but are too small and spatially entwined with Ironbark Open Forest Complex to be mapped separately.

Where the community occurs on low rises in the Bobadeen region which have been previously cleared and grazed, it occurs in a regenerating form. The floristic composition is similar to that of the mature and intact community however; the canopy is dominated by low trees or occasionally colonising shrub species.

Ironbark Open Forest Complex is the most widespread vegetation community in the proposed Ulan West mining area. It is a diverse community comprising a number of variants and a variety of structural forms such as dry open forests, low forests, woodlands and heathlands that occur in mosaic patterns across the sandstone hillslopes and crests, with a high diversity of species in varying abundance.

4.1.2.1.3 Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium

Narrow-leaved Ironbark Open Forest forms a tall open forest on sandstone footslopes and flats throughout the sandstone regions of the proposed Ulan West mining area. It generally occurs on a sandy colluvium that stretches between the footslopes of sandstone slopes and valley floors. The canopy is generally 8 to 18 metres in height with 10 to 30 per cent cover. The community is characterised by the dominance of narrow-leaved ironbark (*Eucalyptus crebra*) over a mid-dense shrub stratum and a mid-dense to dense groundcover. Narrow-leaved wattle (*Acacia linearifolia*) is often present as a dominant sub-canopy species. Other common canopy trees recorded generally reflect the canopy of adjacent, related communities and included inland scribbly gum (*E. rossii*), Blakely's red gum (*E. blakelyi*), Dwyer's red gum (*E. dwyeri*), western grey box (*E. microcarpa*) and black cypress pine (*Callitris endlicheri*).

The shrub stratum is generally less than 2 metres in height with less than 10 per cent cover, however dense patches can occur. Commonly recorded species include pink five-corners (*Styphelia triflora*), blunt beard-heath (*Leucopogon muticus*), narrow-leaved geebung

(*Persoonia linearis*), dolly bush (*Cassinia aculeata*), *Sannantha cunninghamii*, *Cassinia quinquefaria*, ruby urn heath (*Melichrus erubescens*), daphne heath (*Brachyloma daphnoides*), *Hibbertia circumdans*, *Leptospermum parvifolium*, *L. trinervium* and *Bossiaea rhombifolia* subsp. *concolor*.

The ground cover is often moderately dense with 50 to 60 per cent cover; however the ground cover vegetation may be sparse in places. Common species include silky purple-flag (*Patersonia sericea*), *Dianella* spp., *Phyllanthus hirtellus*, weeping grass (*Microlaena stipoides* var. *stipoides*), rough saw-sedge (*Gahnia aspera*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), kidney weed (*Dichondra repens*), native cranberry (*Astroloma humifusum*), peach heath (*Lissanthe strigosa*), urn heath (*Melichrus urceolatus*), *Gonocarpus elatus* and *Glycine tabacina*.

Narrow-leaved Ironbark Open Forest is commonly associated with Scribbly Gum Woodland – Heathland as it occurs in similar habitats and in many places mapping of each community will inadvertently include components of the both.

Where gullies pass through Narrow-leaved Ironbark Open Forest, intergrades between this community and Rough-barked Apple Open Forest will occur.

Narrow-leaved wattle (*Acacia linearifolia*) is a common canopy tree in Narrow-leaved Ironbark Open Forest. In some sites it becomes dominant, forming stands of *Acacia* Forest that have not been mapped separately due to mapping limitations.

A regenerating variant of this community is present in the west of the proposed Ulan West mining area, in an area that was previously cleared. This variant is floristically similar to the mature and intact community, however, it is structurally different, due to the historical clearing and grazing of the area.

Narrow-leaved Ironbark Open Forest is floristically and structurally similar to Ironbark Open Forest Complex and Stringybark – Ironbark Open Forest and in areas of low relief, it forms intergrades with these units.

4.1.2.1.4 She Oak Low Forest on Sandstone Crests

She Oak Low Forest is a low (less than 10 metres in height), closed forest dominated by mostly monospecific stands of she oak (*Allocasuarina gymnanthera*) over a very sparse understorey. This community typically occurs in small patches on level crest sites with little sandstone outcropping. Emergent trees, up to 14 metres in height, including broad-leaved ironbark (*Eucalyptus fibrosa*), narrow-leaved stringybark (*E. sparsifolia*) and Dwyer's red gum (*E. dwyeri*) are common and generally reflect the flora of adjacent communities, the most common of which is Ironbark Open Forest Complex. A sub-canopy is uncommon, but may be present comprising seedlings of the eucalypt species together with mature narrow-leaved geebung (*Persoonia linearis*).

The allelopathic effect of *Allocasuarina gymnanthera* generally results in a very sparse understorey (usually less than 10 per cent cover). Shrubs recorded in the community include blunt beard-heath (*Leucopogon muticus*), *Boronia rubiginosa*, prickly shaggy pea (*Podolobium ilicifolium*), *Pultenaea cinerascens*, peach heath (*Lissanthe strigosa*), *Harmogia densifolia*, bitter cryptandra (*Cryptandra amara*) and scarlet mint-bush (*Prostanthera aspalathoides*).

The very sparse ground cover may include *Pseudanthus divaricatissimus*, *Phyllanthus hirtellus*, pomax (*Pomax umbellata*), wiry panic (*Entolasia stricta*), wattle mat-rush (*Lomandra filiformis* subsp. *filiformis*) and forest goodenia (*Goodenia hederacea* subsp. *hederacea*).

She Oak Low Forest is spatially and floristically related to Ironbark Open Forest Complex, which usually surrounds the community and forms intergrades with it on sandstone crests. She Oak Low Forest is also related to Stringybark – Ironbark Open Forest as it occurs in similar habitat on crests and upper slopes. The three communities have many species in common although there are clear differences in community structure, density and dominance patterns.

4.1.2.1.5 Rough-barked Apple Open Forest on Alluvium/Colluvium

Rough-barked Apple Open Forest is the dominant riparian community in the southern part of the proposed Ulan West mining area, where the dominant parent rock is sandstone and the drainage lines are deeply incised. In the northern part of the proposed Ulan West mining area, in proximity to the Bobadeen area, where the drainage lines are broader, the community occurs on colluvium at the margins of alluvial flats. The canopy is dominated by rough-barked apple (*Angophora floribunda*) up to a height of 18 metres with 20 to 40 per cent cover. Blakely's red gum (*Eucalyptus blakelyi*), yellow box (*E. melliodora*) and, to a lesser extent, western grey box (*E. microcarpa*) and narrow-leaved ironbark (*E. crebra*) can occur as co-dominant species. Inland scribbly gum (*E. rossii*) also occurs in sandy drainage lines adjacent to flats supporting Scribbly Gum Woodland – Heathland. Narrow-leaved wattle (*Acacia linearifolia*) commonly occurs as the sole species in a low tree layer.

The shrub layer is generally sparse, with 5 to 20 per cent cover. Common shrubs include narrow-leaved geebung (*Persoonia linearis*), prickly shaggy pea (*Podolobium ilicifolium*), dolly bush (*Cassinia aculeata*) and sifton bush (*C. arcuata*).

The ground cover is sparse to moderately dense and typically comprises more mesic species such as kidney weed (*Dichondra repens*), *Ranunculus sessiliflorus* var. *sessiliflorus*, stinking pennywort (*Hydrocotyle laxiflora*), trailing speedwell (*Veronica plebeia*), prickly starwort (*Stellaria pungens*), common chickweed (*S. media*), *Hydrocotyle peduncularis*, weeping grass (*Microlaena stipoides* var. *stipoides*), forest hedgehog grass (*Echinopogon ovatus*), *Glycine tabacina* and swamp dock (*Rumex brownii*).

A regenerating variant of Rough-barked Apple Open Forest occurs in valleys that have been previously cleared and grazed. This variant is broadly similar in its floristic composition to the mature form of the community; however the canopy layer exists as regenerating trees with some scattered mature rough-barked apple trees.

Rough-barked Apple Open Forest is closely related to Blakely's Red Gum Open Forest, which occurs in the centre of broad alluvial flats, adjacent to Rough-barked Apple Open Forest. On the upper reaches of drainage lines on colluvial, sandstone slopes, Rough-barked Apple Open Forest is affiliated with Stringybark – Ironbark Open Forest where the two communities intergrade.

4.1.2.1.6 Stringybark – Ironbark Open Forest on Sandstone Slopes

Stringybark – Ironbark Open Forest is typically a dry, mid-high open forest to woodland up to 20 metres in height with 20 to 40 per cent cover. The canopy is dominated by narrow-leaved stringybark (*Eucalyptus sparsifolia*) and broad-leaved ironbark (*E. fibrosa*). Other common canopy trees include blue-leaved stringybark (*E. agglomerata*), and red stringybark (*E. macrorhyncha* subsp. *macrorhyncha*). In more sheltered sites with higher soil moisture, such as gully heads and lower slopes, rough-barked apple (*Angophora floribunda*) is common, where the community grades into Rough-barked Apple Open Forest. Other trees that occur in low abundance include inland scribbly gum (*E. rossii*), grey gum (*E. punctata*), narrow-leaved ironbark (*E. crebra*) and Blakely's red gum (*E. blakelyi*).

The understorey typically comprises a sparse to mid-dense sclerophyllous shrub stratum, which becomes dense in small areas often on skeletal soils where trees are less dominant. The shrub layer is generally up to 2 metres, but is occasionally up to 4 metres in height, with 5 to 50 per cent cover. Common and dominant shrubs recorded are dolly bush (*Cassinia aculeata*), *C. quinquefaria*, sifton bush (*C. arcuata*), *Pultenaea cinerascens*, prickly shaggy pea (*Podolobium ilicifolium*), blunt beard-heath (*Leucopogon muticus*), *Hibbertia circumdans*, hoary Guinea flower (*H. obtusifolia*), Daphne heath (*Brachyloma daphnoides*), urn heath (*Melichrus urceolatus*), native blackthorn (*Bursaria spinosa* subsp. *spinosa*) and narrow-leaved geebung (*Persoonia linearis*).

The ground cover is dry and sparse with areas of dense growth uncommon with cover generally being less than 10 per cent. A range of forbs, ferns and grasses characterise the community including poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), rock fern (*C. austrotenuifolia*), necklace fern (*Asplenium flabellifolium*), *Poranthera corymbosa*, *Caladenia* spp., *Phyllanthus hirtellus*, silky purple-flag (*Patersonia sericea*), *Dianella revoluta* var. *revoluta,* native geranium (*Geranium solanderi*), mat-rush (*Lomandra confertifolia*), many-flowered mat-rush (*L. multiflora* subsp. *multiflora*), rough saw-sedge (*Gahnia aspera*), urn heath (*Melichrus urceolatus*), ruby urn heath (*M. erubescens*), and native cranberry (*Astroloma humifusum*).

Stringybark – Ironbark Open Forest occurs on well drained, rocky sandstone slopes, typically in mid to upper slope positions in dissected sandstone landscapes. The most well-developed stands of Stringybark – Ironbark Open Forest tend to occur on steeper rocky slopes. In many sites, particularly those with a sheltered aspect, Stringybark – Ironbark Open Forest forms a very tall canopy over a sparse to very sparse understorey where sandstone outcrops and boulder debris are common.

This community is closely affiliated with Ironbark Open Forest Complex which usually occurs on adjacent sandstone crests. Intergrades between the Ironbark Open Forest Complex and Stringybark – Ironbark Open Forest are very common, particularly on steep to moderately inclined slopes and in upper slope positions.

On sheltered slopes, Stringybark – Ironbark Open Forest forms an intergrade with Rough-barked Apple Open Forest, particularly on mid- to lower-slopes where the units abut.

Dry Heathland develops in areas of Stringybark – Ironbark Open Forest where heath becomes dominant and the tree canopy very sparse, which typically occurs on rocky ledges. Many such areas occur throughout Stringybark – Ironbark Open Forest that have not been mapped as the heathland due to their small patch sizes. As such, these areas are considered as a common component of Stringybark – Ironbark Open Forest.

On sheltered slopes in the southern part of the proposed Ulan West mining area, grey gum (*E. punctata*) commonly occurs as a co-dominant species with broad-leaved ironbark (*E. fibrosa*), with narrow-leaved stringybark (*E. sparsifolia*) occurring occasionally. The understorey is floristically similar in this variant, although the shrub layer is generally sparser.

4.1.2.2 Woodland Formation

4.1.2.2.1 Grey Box Woodland

Grey Box Woodland occurs on sandy flats and lower slopes on colluvium. The canopy is dominated by western grey box (*Eucalyptus microcarpa*) and is generally up to 20 metres high with 15 to 20 per cent cover. Narrow-leaved ironbark (*E. crebra*) occurs sparsely through the community and a sparse sub-canopy of bulloak (*Allocasuarina luehmannii*) is occasionally present. Grey box (*E. moluccana*) has also been recorded in this community.

The shrub layer is generally sparse with 5 to 15 per cent cover and is less than 2 metres in height. Common species include sifton bush (*Cassinia arcuata*), violet kunzea (*Kunzea parvifolia*), sticky hop-bush (*Dodonaea viscosa* subsp. *spatulata*), broom bitter pea (*Daviesia genistifolia*), western golden wattle (*Acacia decora*), currawang (*A. doratoxylon*), hickory wattle (*A. implexa*), varnish wattle (*A. verniciflua*) and native blackthorn (*Bursaria spinosa* subsp. *spinosa*).

The threatened Ausfeld's wattle (*A. ausfeldii*), which is listed as vulnerable under the TSC Act, was also recorded in this community in the Ulan Coal Complex but not within the proposed Ulan West mining area.

The groundcover is dense with up to 40 per cent cover and comprises native forbs, grasses and ferns. Common species include three-awn wiregrass (*Aristida vagans*), mat-rush (*Lomandra confertifolia*), slender wire lily (*Laxmannia gracilis*), poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), purple burr-daisy (*Calotis cuneifolia*), small St Johns wort (*Hypericum gramineum*), peach heath (*Lissanthe strigosa*), native cranberry (*Astroloma humifusum*) and *Glycine tabacina*.

A regenerating variant of this community is present in the north of the proposed modification Area, within the current salinity offset area, in an area previously cleared for grazing purposes. The floristic composition of the regenerating community is similar to that of the mature, remnant community. Structurally, a canopy is generally absent, with regenerating grey box (*E. microcarpa*) trees in the understorey and the colonising species sifton bush (*Cassinia arcuata*) is commonly the dominant understorey species.

Grey Box Woodland is closely related to Narrow-leaved Ironbark Open Forest and both communities occur in similar parts of the landscape, being lower slopes and flats on colluvium.

Grey Box Woodland is also related to White Box Woodland, sharing a number of common species, and both communities occur in similar parts of the landscape in the Bobadeen area. Grey Box Woodland does not form part of a TEC.

4.1.2.2.2 Scribbly Gum Woodland – Heathland on Sand Plateaux

Scribbly Gum Woodland – Heathland comprises two sub-communities that occur in the proposed Ulan West mining area in a mosaic pattern that cannot be practically separated at the scale of mapping applied. The sub-communities are: (1) Scribbly Gum – Ironbark Woodland over a mid-dense to closed low shrub stratum; and (2) Heathland with woody emergent trees present at 5 per cent cover or less. The woodland sub-community is the more widespread of the two sub-communities. The heathland sub-community occurs in patches within the woodland where tree emergents are very sparse to absent and shrubs form the dominant upper stratum. Such areas often have very coarse, sandy soils. The characteristic heath shrubs are also present in the woodland component of this community.

The canopy of Scribbly Gum Woodland is generally 12 to 18 metres in height with a canopy cover of 30 to 45 per cent. Characteristic canopy species include inland scribbly gum (*Eucalyptus rossii*), with narrow-leaved ironbark (*E. crebra*) common to co-dominant in areas, particularly where Narrow-leaved Ironbark Open Forest occurs on adjacent slopes. Grey gum (*E. punctata*), rough-barked apple (*Angophora floribunda*) and Blakely's red gum (*E. blakelyi*) were also recorded, particularly in areas influenced by open depressions. Lower trees recorded included narrow-leaved geebung (*Persoonia linearis*), black cypress pine (*Callitris endlicheri*) and sword-leaved wattle (*Acacia gladiiformis*).

In both sub-units, the lower and shrub strata often occur as a continuum rather than forming distinct strata. The shrub stratum in both the woodland and heathland variants is up to three

metres in height with 20 to 70 per cent cover. Common and dominant shrubs recorded include *Sannantha cunninghamii*, pink five-corners (*Styphelia triflora*), *Grevillea sericea*, common fringe-myrtle (*Calytrix tetragona*), *Leptospermum parvifolium*, *L. arachnoides*, blunt beard-heath (*Leucopogon muticus*), *Kunzea parvifolia*, urn heath (*Melichrus urceolatus*), ruby urn heath (*M. erubescens*), thyme-leaved paperbark (*Melaleuca thymifolia*), *Grevillea triternata* and *Persoonia curvifolia.*

The ground cover is usually very sparse with less than 20 per cent cover, particularly where a dense shrub stratum occurs. Forbs and grasses found in Scribbly Gum Woodland – Heathland include finger orchids (*Caladenia* spp.), pomax (*Pomax umbellata*), reedgrass (*Arundinella nepalensis*) and many-flowered mat-rush (*Lomandra multiflora* subsp. *multiflora*).

Scribbly Gum Woodland – Heathland is a widespread community in the Ulan Coal Complex, but occurs in only one northern location within the Proposed Surface Infrastructure Area.

Due to the habitat and low relief in this community, Scribbly Gum Woodland – Heathland often forms intergrades with closely related, adjacent vegetation units including Narrow-leaved Ironbark Open Forest.

In some areas Scribbly Gum Woodland – Heathland and Narrow-leaved Ironbark Open Forest are spatially related and occur in a mosaic across the landscape and many areas mapped as either community may contain components of both.

Scribbly Gum Woodland – Heathland occurs throughout the Pilliga and Narrabeen sandstone parts of the Maximum Subsidence Affectation Area. It is typical of gently sloping to level sandy plains that lie below adjacent sandstone cliffs and steeper slopes. The best developed stands of this unit occur on siliceous sand plains and very gently undulating hills in the central to northern areas of the proposed Ulan West mining area.

4.1.2.2.3 White Box Woodland

White Box Woodland is restricted to the fertile Tertiary basalt-derived soils in the Bobadeen and Box Hill regions, which have been largely cleared for agricultural purposes and have been historically grazed. It is characterised by the predominance of white box (*Eucalyptus albens*), 10 to 20 metres in height. The canopy is generally relatively sparse, with a cover of approximately 10-20 per cent. Regeneration of white box in the understorey is present in some locations where grazing pressure has been reduced. Other canopy species such as narrow-leaved ironbark (*E. crebra*) and Blakely's red gum (*E. blakelyi*) can occur less commonly.

Often no understorey is present, however in some areas a sparse to moderate shrub layer occurs which is generally up to 2 metres in height, with 5 to 30 per cent cover. Commonly recorded species within the understorey include sifton bush (*Cassinia arcuata*), *C. quinquefaria*, hakea wattle (*Acacia hakeoides*) and Australian indigo (*Indigofera australis*).

The ground cover is usually dense (50 to 95 per cent cover) with a diversity of native grasses and forbs. Commonly recorded species include purple wiregrass (*Aristida ramosa*), Queensland bluegrass (*Dichanthium sericeum*), speargrass (*Austrostipa scabra* subsp. *scabra*), biddy biddy (*Acaena novae-zelandiae*), kidney weed (*Dichondra repens*), stinking pennywort (*Hydrocotyle laxiflora*), *Glycine tabacina*, native geranium (*Geranium solanderi*), sticky everlasting (*Xerochrysum viscosum*), yellow burr-daisy (*Calotis lappulacea*) and *Oncinocalyx betchei*. Due to the disturbance history of the community and the fertility of the soil, perennial weed species can be common to abundant in some areas, the cover of which is seasonably variable. Dominant weed species include saffron thistle (*Carthamus lanatus*) and perennial ryegrass (*Lolium perenne*).

A regenerating variant of White Box Woodland is present predominately at the southern end of LW 8 (generally known as Box Hill) and in the Bobadeen area. At Box Hill, the community is composed of an understorey dominated by native grasses and forbs, with scattered regenerating white box (*E. albens*) trees. This area is likely to have been heavily grazed in the past and white box regeneration has occurred since the grazing pressure was removed. This community is likely to regenerate back to White Box Woodland in the future, if natural regeneration is allowed to continue.

Modified White Box Woodland is a variant of White Box Woodland, also present in the Bobadeen area. It comprises native grasslands containing scattered white box trees, which have a canopy cover of less than 5 per cent. This variant of White Box Woodland was mapped separately to reflect the level of modification of the community through clearing and grazing, although the species composition is similar to that of the more intact White Box Woodland.

White Box Woodland (and its modified variant) is closely related to Derived Native Grasslands as these areas are likely to have once comprised the White Box Woodland and have been completely cleared of tree species. White Box Woodland is also closely related to Box – Red Gum Open Forests which occur down slope from White Box Woodland, where basalt soils have been washed into adjacent open depressions. The two communities share many common species.

This community is listed as an EEC under the TSC Act and a CEEC under the EPBC Act.

4.1.2.2.4 Yellow Box – Red Gum Woodland

Yellow Box – Red Gum Woodland is a riparian woodland which occurs along lower order drainage lines across the Ulan Coal Complex, such as Bobadeen Creek. Yellow Box – Red Gum Woodland is a tall woodland with a canopy dominated by yellow box (*Eucalyptus melliodora*) and Blakely's red gum (*E. blakelyi*). The canopy is generally 15 to 20 metres in height with 15 to 20 per cent cover. Rough-barked apple (*Angophora floribunda*) occurs occasionally within this community.

The understorey is sparse to moderately dense, or it is sometimes absent. When present, the understorey is composed of sifton bush (*Cassinia arcuata*), *C. aculeata* and daphne heath (*Brachyloma daphnoides*), as well as regenerating eucalypts. The understorey is generally less than 2 metres in height, with 5 to 30 per cent cover.

The ground cover is composed of native and introduced grasses and forbs with 50 to 75 per cent cover. Characteristic species include tall sedge (*Carex appressa*), native geranium (*Geranium solanderi*), swamp dock (*Rumex brownii*), common woodruff (*Asperula conferta*), kidney weed (*Dichondra repens*), *Glycine tabacina*, slender bamboo grass (*Austrostipa verticillata*), weeping grass (*Microlaena stipoides* var. *stipoides*) and scented-top grass (*Capillipedium spicigerum*).

Yellow Box – Red Gum Woodland occurs on slopes and floodplains associated with significant drainage lines throughout the Bobadeen region, generally in proximity to White Box Woodland. Much of this community has been previously cleared for agricultural purposes and has been subject to grazing, with some areas still undergoing grazing. The community also contains a relatively high proportion of weed species due to the disturbance history of the area, the high fertility of the soil, and its proximity to a watercourse.

This community is listed as an EEC under the TSC Act and a CEEC under the EPBC Act.

Yellow Box – Red Gum Woodland is closely related to Blakely's Red Gum Open Forest which, which occurs on broad alluvial flats in tributaries of Bobadeen Creek, where Yellow Box – Red Gum Woodland dominates. It also is structurally and floristically similar to White Box Woodland.

4.1.2.3 Heathland Formation

4.1.2.3.1 Dry Heathland on Rocky Outcrops

Dry Heathland is a restricted community characterised by a mid-dense to dense heath shrub stratum up to 3 metres in height with emergent trees absent to very sparse (less than 5 per cent cover). Dominant heath shrubs may include, but not necessarily be limited to, common fringe-myrtle (*Calytrix tetragona*), *Hibbertia circumdans*, tantoon (*Leptospermum polygalifolium*), *L. parvifolium*, blunt beard-heath (*Leucopogon muticus*), *L. attenuatus*, *Cassinia quinquefaria*, *Gonocarpus elatus*, native fuschia (*Correa reflexa*), *Dillwynia sericea*, pink spider flower (*Grevillea sericea*), *Allocasuarina diminuta* and Australian indigo (*Indigofera australis*).

Emergent trees in Dry Heathland are usually found as dominant or common trees in adjacent forest communities. Trees are often stunted and low due to poor soil conditions and mallee growth forms are common. Common emergents include broad-leaved ironbark (*Eucalyptus fibrosa*), narrow-leaved stringybark (*E. sparsifolia*), blue-leaved stringybark (*E. agglomerata*), Dwyer's red gum (*E. dwyeri*), black cypress pine (*Callitris endlicheri*), narrow-leaved geebung (*Persoonia linearis*) and sword-leaved wattle (*Acacia gladiiformis*).

The ground cover is typically very sparse and commonly occurring species include poison rock fern (*Cheilanthes sieberi* subsp. *sieberi*), rock fern (*C. austrotenuifolia*), *Platysace ericoides*, *Pseudanthus divaricatissimus*, *Drosera peltata* and greenhood orchids (*Pterostylis* spp.).

Dry Heathland occurs in small patches (often 10 x 10 metres or less) that are generally restricted to sandstone rock outcrops, cliff ledges and crests with skeletal soils and sandstone outcropping. Locations of Dry Heathland are typically dominated by one to two sclerophyllous shrub species, which vary between heathland sites. Plants found in the heathland usually reflect the shrub composition that is found in the adjacent open forest communities, which are typically Ironbark Open Forest Complex and Stringybark – Ironbark Open Forest. Where soils are deeper, a tree canopy tends to become more dominant and the adjacent forest communities develop.

Dry Heathland is closely related to communities that occur on adjacent sandstone crest and slopes, which are typically Ironbark Open Forest Complex and Stringybark – Ironbark Open Forest. Sites of Dry Heathland that were too small to map separately occur throughout these forested communities. These communities have many species in common and the plant composition of Dry Heathland is usually composed of species found in adjacent communities.

4.1.2.4 Grassland Formation

4.1.2.4.1 Derived Native Grassland

Derived Native Grassland occurs on relatively fertile soil throughout the Bobadeen region, in areas that are likely to have once been dominated by white box (*Eucalyptus albens*), Blakely's red gum (*E. blakelyi*) and yellow box (*E. melliodora*), or a combination of these species, based on the current (post-disturbance) distribution of these species.

This community is composed of native and introduced grasses and forbs and is largely devoid of mature and regenerating trees. Commonly recorded species include speargrass (*Austrostipa scabra* subsp. *scabra*), slender rats tail grass (*Sporobolus creber*), kangaroo grass (*Themeda australis*), common cotula (*Cotula australis*), bears ears (*Cymbonotus lawsonianus*), cotton fireweed (*Senecio quadridentatus*), *Acaena ovina* and tick indigo (*Indigofera adesmiifolia*). A relatively sparse shrub layer dominated by sifton bush (*Cassinia arcuata*) also occurs in some places.

Derived Native Grassland is closely related to White Box Woodland, Yellow Box – Red Gum Woodland and Blakely's Red Gum Open Forest, as it is likely to have once been part of these communities prior to clearing. The community currently comprises a similar understorey to that which is commonly found in White Box Woodland, Blakely's Red Gum Open Forest and Yellow Box – Red Gum Woodland, although the occurrence of weeds is usually higher.

This community is listed as an EEC under the TSC Act and a CEEC under the EPBC Act. The absence of characteristic canopy species is related to disturbance history and does not exclude this community from the TEC delineations.

4.1.2.4.2 Improved Pasture

Improved Pasture includes grassland and irrigated pastures, dominated by perennial and annual species, the majority of which are exotic. Improved Pastures are located mainly in the Bobadeen region in areas that have experienced high levels of disturbance from agricultural activities for an extended period of time.

4.1.2.4.3 Unimproved Pasture

Unimproved Pasture includes grasslands, native or exotic, which are not subject to irrigation or other forms of improvement from an agricultural perspective. These areas have undergone grazing or other disturbance for an extensive period of time and consequently the occurrence of weed species is generally high. Grasslands in proximity to woodland areas generally contain similar understorey species to those contained in the adjacent communities. Grasslands with a high proportion of native grasses and forbs and which contain species which do not conform to listed TECs, are also included in this community.

4.1.2.5 Cleared Formation

4.1.2.5.1 Cleared

Areas mapped as Cleared have been cleared for mining, infrastructure or for quarries and do not contain any substantial areas of vegetation.

4.1.2.5.2 Water Bodies

These areas have been mapped to signify large water bodies such as Rowans Dam and Bobadeen Dam. While there are large numbers of smaller dams throughout the proposed Ulan West mining area, these are not material to the assessment process. Additionally, large areas of water collecting within open cut voids have been mapped, where these are substantial enough to be relatively permanent, and able to provide some degree of habitat for water birds.

4.1.3 Threatened Flora Species

For the purposes of database searches, the standard 10 kilometre search area was used to capture known (or potential) threatened flora records falling within the proposed modification areas. The results of these database searches are provided in **Appendix B**. This Appendix contains an assessment of the potential for all threatened species, endangered populations and TECs identified as part of this assessment to occur within the proposed modification areas. **Appendix B** also contains additional potential threatened species identified from a number of other sources, including literature reviews and professional opinion. Those species considered to have potential habitat within the proposed modification areas are listed in **Table 4.6**.

Table 4.6 - Threatened Flora Species with Potential to occur in Proposed Ulan West Mining Area

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
Ausfeld's wattle *Acacia ausfeldii*	V (TSC)	Moderate. Previously recorded within Ulan Coal Complex, however not within the proposed modification areas.
painted diuris *Diuris tricolor*	V (TSC)	Low. Previously recorded in local area, however not within Ulan Coal Complex or proposed modification areas.
Cannon's stringybark *Eucalyptus cannonii*	V (TSC)	Low. Previously recorded in local area, however not within Ulan Coal Complex or proposed modification areas.
Homoranthus darwinioides	V (TSC) V (EPBC)	Moderate. Previously recorded within Ulan Coal Complex, however not within the modification areas.
hoary sunray *Leucochrysum albicans* var. *tricolor*	E (EPBC)	Moderate. Previously recorded within Ulan Coal Complex, however not within the proposed modification areas.
scant pomaderris *Pomaderris queenslandica*	E (TSC)	Moderate. Previously recorded within Ulan Coal Complex, however not within the proposed modification areas.

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

4.1.3.1 Threatened Flora Species Recorded

No threatened flora species were recorded from the proposed modification areas during the field survey completed for this assessment. Although threatened flora species have been recorded in the Ulan Coal Complex as part of the UCCO Project Ecological Assessment (Umwelt 2009a), none of these records fall within (or near to) the proposed modification areas, or would have the potential to be impacted by the proposed modification.

4.1.4 Endangered Flora Populations

No endangered flora populations have been recorded, or are likely to occur within the proposed modification areas.

4.1.5 Threatened Ecological Communities

A number of TECs have distributions that include the Ulan Coal Complex (see **Appendix B**), and each has been assessed for potential habitat within the proposed modification areas. Those TECs considered to occur within the proposed modification areas are listed in **Table 4.7**.

Table 4.7 - Threatened Ecological Communities (TECs) within the Proposed Modification Areas

TEC	Status	Presence in Proposed Modification Areas and Potential to be Impacted
White Box – Yellow Box – Blakely's Red Gum Woodland	EEC (TSC)	Recorded during surveys of proposed modification areas. Previously recorded within Ulan Coal Complex, as well as extensively throughout local area.
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC (EPBC)	Recorded during surveys of proposed modification areas. Previously recorded within Ulan Coal Complex, as well as extensively throughout local area.

Key: EEC = Endangered Ecological Community
CEEC = Critically Endangered Ecological Community
TSC = *Threatened Species Conservation Act* 1995
EPBC = *Environment Protection and Biodiversity Conservation Act* 1999

One TEC, being White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands (listed as an EEC under the TSC Act and as CEEC under the EPBC Act) has been previously recorded within the Ulan Coal Complex (Umwelt 2009a).

4.2 Fauna Results

The fauna survey component of this Ecological Assessment was completed by BMS (2014), which is provided as **Appendix A**. A summary of the results has been provided below. Other fauna species have additionally been recorded within the Ulan Coal Complex, and it is considered likely that many of these species also occur within the proposed modification areas.

4.2.1 Fauna Species Recorded

A total of 132 vertebrate fauna species were recorded during surveys of the proposed modification areas. This included 85 bird species, 14 reptile species, four amphibian species and 29 mammal species. Of these recorded species, eight (6 per cent) were introduced species (mammals). An outline and discussion of the species recorded within each of the four major fauna groups is presented in the following sections.

A list of all fauna species recorded within the proposed modification areas is presented in **Appendix D** of this report.

Records of species within a particular area do not suggest it only occurs within that specific part of the proposed modification areas, and not within other parts. The high levels of mobility of many fauna species (particularly many birds and mammals) mean that those species could readily occur in areas other than where they were recorded. For this reason, significant fauna records obtained from surveys throughout the Ulan Coal Complex have

been considered within the impact assessment where they have the potential to occur in the habitats of the proposed modification areas.

4.2.1.1 Amphibians

Four amphibian species were recorded across the proposed modification areas, being the eastern banjo frog (*Limnodynastes dumerilii*), ornate banjo frog (*Limnodynastes ornatus*), painted burrowing frog (*Neobatrachus sudelli*) and Bibrons toadlet (*Pseudophryne bibronii*).

No threatened or introduced amphibian species have been recorded in the proposed modification areas.

4.2.1.2 Reptiles

Fourteen reptile species were recorded during surveys of the proposed modification areas, including the eastern bearded dragon (*Pogona barbata*), lace monitor (*Varanus varius*) and nobby lizard (*Amphibolurus nobbi nobbi*). Other reptile species were recorded during surveys of the proposed modification areas; and these are provided in full in **Appendix D**.

No threatened or introduced reptile species have been recorded in the proposed modification areas.

4.2.1.3 Birds

Eighty five birds were recorded throughout the proposed modification areas during surveys, representing a total of 37 families. The most speciose families were the Meliphagidae (13 species) and Acanthizidae (10 species). A list of all bird species recorded in the proposed modification areas is provided in **Appendix D** and detailed in **Appendix A**.

Bird species recorded included eight species listed as vulnerable under the TSC Act, being the glossy black-cockatoo (*Calyptorhynchus lathami*), brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), speckled warbler (*Chthonicola sagittata*), black-chinned honeyeater (eastern subspecies) (*Melithreptus gularis gularis*), scarlet robin (*Petroica boodang*), grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*), varied sittella (*Daphoenositta chrysoptera*), diamond firetail (*Stagonopleura guttata*). One migratory species listed under the EPBC Act was additionally recorded, being the rainbow bee-eater (*Merops ornatus*).

No introduced bird species were identified within the proposed modification areas.

4.2.1.4 Mammals

Twenty-nine mammal species were identified within the proposed modification areas during surveys, as presented in **Appendix D**. The most speciose mammal family recorded was the Vespertilionidae (Vesper-bats), with nine species recorded, including one threatened species, the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) listed as vulnerable under the TSC Act. One additional threatened species was recorded being the koala (*Phascolarctos cinereus*), which is listed as vulnerable under both the TSC Act and EPBC Act.

Eight of the 29 mammal species recorded (28 per cent) were introduced, including the cat (*Felis catus*), rabbit (*Oryctolagus cuniculus*) and fox (*Vulpes vulpes*).

4.2.2 Fauna Habitats

4.2.2.1 Woodland Formation Habitats

The woodland formation is highly variable, comprising a number of communities that are generally structurally and floristically diverse. Despite this variance in communities, the fauna habitat they provide is comparable across the formation. The canopy is dominated by a variety of eucalypt species and a well-developed and varied shrub layer is generally present, comprising a range of wattles (*Acacia* spp.), sifton bush (*Cassinia arcuata*), narrow-leaved geebung (*Persoonia linearis*), blunt beard-heath (*Leucopogon muticus*) and pink five corners (*Styphelia triflora*). The groundcover of the woodland formation generally comprises grasses, litter and rock cover.

The woodland formation provides habitat for a variety of fauna species, particularly birds. This is reflected by the large numbers of bird species recorded across the proposed modification areas, particularly species that are considered to be woodland dependent.

This formation contains a number of specific habitat resources for bird species, including threatened species. A moderate abundance of mistletoe (*Amyema* spp.) provides resources for specialist species such as the nomadic painted honeyeater (*Grantiella picta*). Winter-flowering canopy trees are moderately widespread and provide important resources for winter migrants such as the swift parrot (*Lathamus discolor*). The diversity of flowering canopy trees throughout the woodland formation provides a year-round resource for nectarivorous birds, particularly honeyeaters and lorikeets, such as the little lorikeet (*Glossopsitta pusilla*), as well as arboreal mammals including squirrel glider (*Petaurus norfolcensis*). Such flowering resources attract large numbers of insects which provide foraging habitat for a diversity of threatened micro-bats. Many of the understorey species are valuable flowering resources utilised by a diversity of nectarivorous bird species. Bird assemblages are likely to vary considerably according to such seasonal flowering events.

She-oaks (*Allocasuarina* spp.) occur patchily and provide foraging habitat for cockatoos and parrots, including the threatened glossy black-cockatoo (*Calyptorhynchus lathami*).

Large amounts of terrestrial habitat (leaf litter, rocky areas, low vegetation and fallen timber) provide protection and foraging resources for small terrestrial mammals, such as antechinus, and reptiles. Fallen timber is particularly important in open areas fringing grassland, as it provides valuable foraging perches for species such as the hooded robin (southern form) (*Melanodryas cucullata cucullata*), where they forage in the grasslands, then return regularly to woodland areas for cover. The moderately dense shrub and canopy layers provide excellent habitat for arboreal mammals, such as possums and gliders.

4.2.2.2 Forest/Open Forest Formation Habitats

Due to the similarities in vegetation structure and floristics between the Woodland and Forest/Open Forest formations, the habitat complexities are also very similar. While the canopy dominants of the Forest/Open Forest formation differ from those of the Woodland, there are still a diversity of species that would provide an almost year round resource for nectarivorous species, such as lorikeets and parrots, as well as arboreal mammals and micro-bats. Winter-flowering ironbarks are common in the Forest/Open Forest formation, providing resources for seasonally nomadic bird species.

She-oaks (*Allocasuarina* spp.) occur patchily and provide foraging habitat for cockatoos and parrots, including the threatened glossy black-cockatoo (*Calyptorhynchus lathami*). A low to moderate abundance of mistletoe (*Amyema* spp.) provides resources for specialist species such as the semi-nomadic honeyeaters.

The moderately dense understorey strata provide protection and foraging resources for a large diversity of bird groups, including thornbills, wrens, robins and honeyeaters. Similarly, the ground stratum is moderately dense and offers habitat for terrestrial species including small mammals and reptiles. Some areas of the Forest/Open Forest formation, provide rocky cliff lines with more diverse habitat for reptiles.

The Forest/Open Forest habitats contain areas of outcropping granite boulders and/or areas of granite or sandstone rock cover, generally in the upper slopes and occasionally on ridge lines. Cliff lines are generally 10-15 metres in height, with large amounts of fallen rock ranging in size from massive boulders and cliff faces, to smaller rocks along the slopes and valley floor. Such a rocky environment provides high quality habitat for reptiles, with abundant rock-on-rock habitat for geckoes, as well as rock-on-soil habitat for skinks and snakes. The diversity of ecological niches in these areas allow for habitat specialists such as rock warblers and treecreepers to occur. These cliff line areas also provide particularly high quality habitat for micro-bat species. The mature, complex vegetation types provide excellent foraging habitat for these species, and the abundance of hollows, peeling bark and tree fissures provide an abundance of habitat for tree-roosting species. Similarly, the extensive cliff line areas provide potential habitat for cave-roosting species.

4.2.2.3 Heathland Formation Habitats

Heathland occurs throughout the proposed modification areas in small patches that are generally restricted to sandstone rock outcrops, cliff ledges and crests with skeletal soils and sandstone outcropping. Where soils are deeper, a tree canopy tends to become more dominant and the adjacent forest communities develop.

The rocky, exposed position of the heathland habitats provide ideal habitat for a wide variety of reptile species, in particular geckoes and skinks. The combination of embedded rock, outcropping and loose rock present in this habitat provides a diversity of niches for a range of different reptile species.

The dense, shrubby cover characteristic of heathland provides protection for a wide range of ground-dwelling fauna, in particular reptiles and small mammals. However, given the low density of ground cover vegetation, and the skeletal/shallow nature of the soil, foraging resources for species dependent on underground plant structures such as roots, tubers and fungus may be limited.

The dense cover of flowering shrubs also provides important protection and foraging habitat for small birds such as honeyeaters and thornbills. The open nature of the canopy provides foraging opportunities for predatory birds such as eagles and harriers.

There is limited habitat for arboreal mammals in the heathland habitats of the proposed modification areas, due to the absence or very low density of a tree canopy stratum. Tree hollows in the heathland are very sparse, and would be limited to those of very small size classes due to the stunted size of the trees that grow in these habitats.

4.2.2.4 Grassland Formation Habitats

The grassland habitats of the proposed modification areas have arisen primarily as a result of past clearing for agricultural purposes. This occurred within areas of highly productive soils along the river flats and valleys, mainly in the northern parts of the UCCO Project Area. The health and integrity of the vegetation largely corresponds with the grazing history, particularly grazing intensity.

The grassland areas broadly consist of a dense open pasture, comprising both introduced and native grass and herb species, with remnant paddock trees occurring in small pockets or as isolated eucalypt trees. Many of these isolated trees are very mature, and therefore have well-developed hollows of a range of sizes. Often single trees displayed numerous hollows providing a very important habitat resource for a range of hollow-dependent birds, micro-bats and other mammals.

The ground cover is generally dense and provides excellent foraging habitat and protective cover for terrestrial birds such as quails and pipits. Fallen timber and hollow logs are generally restricted to areas beneath isolated paddock trees. There are very few rocky areas in this habitat type, restricting habitat for reptile species. Ground habitat resources such as hollow logs were restricted to around the bases of these large isolated trees, with very few scattered elsewhere.

The grassland formation areas within the proposed modification areas exhibited moderate levels of disturbance, including moderate to severe levels of grazing (domestic stock and native animals), areas of slight sheet erosion and areas of slight to moderate weed infestation.

4.2.2.5 Cleared Formation Habitats

The cleared formation does not provide any tangible habitat values, due to its highly modified nature. Cleared areas principally relate to areas of existing surface infrastructure or mined areas and do not support any natural vegetation. Given the lack of vegetation and often the highly modified landscape, there are limited fauna habitat values in these areas.

4.2.3 Threatened Fauna Species

For the purposes of database searches, a 10 kilometre search area was used to capture known (or potential) threatened fauna records falling within the proposed modification areas. The results of these database searches are provided in **Appendix B**. This Appendix contains an assessment of the potential for all threatened fauna species and endangered populations identified as part of this assessment to occur within the proposed modification areas. **Appendix B** also contains additional potential threatened species identified from a number of other sources, including literature reviews and professional opinion. Those species considered to have potential habitat within the proposed modification areas are listed in **Table 4.8**.

Table 4.8 - Threatened Fauna Species with Potential to occur in Proposed Modification Areas

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
pink-tailed legless lizard *Aprasia parapulchella*	V (TSC) V (EPBC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
broad-headed snake *Hoplocephalus bungaroides*	E (TSC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
little whip snake *Suta flagellum*	V (TSC)	Low. Has not been recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.

Table 4.8 - Threatened Fauna Species with Potential to occur in Proposed Modification Areas (cont)

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
magpie goose *Anseranas semipalmata*	V (TSC)	Low. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is not present in these areas.
mallefowl *Leipoa ocellata*	E (TSC) V (EPBC) MIG (EPBC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
blue-billed duck *Oxyura australis*	V (TSC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is not present in these areas.
square-tailed kite *Lophoictinia isura*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
black-breasted buzzard *Hamirostra melanosternon*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
spotted harrier *Circus assimilis*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
little eagle *Hieraaetus morphnoides*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
plains wanderer *Pedionomus torquatus*	E (TSC) V (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
Australian painted snipe *Rostratula benghalensis australis*	E (TSC) E (EPBC) MAR (EPBC) MIG (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
bush stone-curlew *Burhinus grallarius*	E (TSC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
glossy black-cockatoo *Calyptorhynchus lathami*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
gang-gang cockatoo *Callocephalon fimbriatum*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
little lorikeet *Glossopsitta pusilla*	V (TSC)	Moderate. Recorded in proposed modification areas.
superb parrot *Polytelis swainsonii*	V (TSC) V (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
swift parrot *Lathamus discolor*	E (TSC) E (EPBC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
turquoise parrot *Neophema pulchella*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.

Table 4.8 - Threatened Fauna Species with Potential to occur in Proposed Modification Areas (cont)

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
powerful owl *Ninox strenua*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
barking owl *Ninox connivens*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
masked owl *Tyto novaehollandiae*	V (TSC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
brown treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
speckled warbler *Chthonicola sagittata*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
regent honeyeater *Anthochaera phrygia*	E (TSC) E (EPBC) MIG (EPBC)	Moderate. Recorded in local area, but not in proposed modification areas. Not recorded during surveys of proposed modification areas.
black-chinned honeyeater (eastern subspecies) *Melithreptus gularia gularis*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
painted honeyeater *Grantiella picta*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
pied honeyeater *Certhionyx variegatus*	V (TSC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
white-fronted chat *Epthianura albifrons*	V (TSC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
scarlet robin *Petroica boodang*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
flame robin *Petroica phoenicea*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
pink robin *Petroica rodinogaster*	V (TSC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
hooded robin (south-eastern form) *Melanodryas cucullata cucullata*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
grey-crowned babbler (eastern subspecies) *Pomatostomus temporalis temporalis*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
varied sittella *Daphoenositta chrysoptera*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.

Table 4.8 - Threatened Fauna Species with Potential to occur in Proposed Modification Areas (cont)

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
Australasian bittern *Botaurus poiciloptilus*	E (TSC) E (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
diamond firetail *Stagonopleura guttata*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
rainbow bee-eater *Merops ornatus*	MIG (EPBC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
spotted-tailed quoll *Dasyurus maculata*	V (TSC) E (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
koala *Phascolarctos cinereus*	V (TSC) V (EPBC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
squirrel glider *Petaurus norfolcensis*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
brush-tailed rock-wallaby *Petrogale penicillata*	E (TSC) V (EPBC)	Low. Species has been recorded in the Ulan Coal Complex on one occasion in 2001. It is possible that this species is no longer extant in the Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
New Holland mouse *Pseudomys novaehollandiae*	V (EPBC)	Low. Not recorded within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
grey-headed flying-fox *Pteropus poliocephalus*	V (TSC) V (EPBC)	Low. Recorded on a single occasion within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
yellow-bellied sheathtail bat *Saccolaimus flaviventris*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
little bentwing-bat *Miniopterus australis*	V (TSC)	Low. Previously recorded within local area, but not within Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
eastern bentwing-bat *Miniopterus schreibersii oceanensis*	V (TSC)	Recorded in proposed modification areas. Recorded previously in Ulan Coal Complex.
south-eastern long-eared bat *Nyctophilus corbeni*	V (TSC) V (EPBC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
little pied bat *Chalinolobus picatus*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
large-eared pied bat *Chalinolobus dwyeri*	V (TSC) V (EPBC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
eastern false pipistrelle *Falsistrellus tasmaniensis*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.

Table 4.8 - Threatened Fauna Species with Potential to occur in Proposed Modification Areas (cont)

Species	Status	Likelihood of Occurrence in Proposed Modification Areas
southern myotis *Myotis macropus*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.
eastern cave bat *Vespadelus troughtoni*	V (TSC)	Moderate. Recorded in Ulan Coal Complex. Not recorded during surveys of proposed modification areas; however appropriate habitat is present.

CE = Critically Endangered
E = Endangered
V = Vulnerable
MIG = Migratory
TSC = *Threatened Species Conservation Act* 1995
EPBC = *Environment Protection and Biodiversity Conservation Act* 1999

4.2.3.1 Threatened Fauna Species Recorded

The UCCO Project Ecological Assessment (Umwelt 2009a) identified a total of 33 threatened fauna species occurring throughout the Ulan Coal Complex; it is anticipated that many of these species occur within the proposed modification areas. Ten threatened fauna species were recorded during field surveys completed of the proposed modification areas. This included eight bird species listed as vulnerable under the TSC Act, being:

- glossy black-cockatoo (*Calyptorhynchus lathami*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- speckled warbler (*Chthonicola sagittata*);
- black-chinned honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- scarlet robin (*Petroica boodang*);
- grey-crowned babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- varied sittella (*Daphoenositta chrysoptera*); and
- diamond firetail (*Stagonopleura guttata*).

Two threatened mammal species were additionally recorded, being the eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) and the koala (*Phascolarctos cinereus*); both are listed as vulnerable under the TSC Act, with the koala also listed as vulnerable under the EPBC Act. One migratory species listed under the EPBC Act was additionally recorded, being the rainbow bee-eater (*Merops ornatus*).

Figure 4.2 shows the threatened fauna species previously recorded (Umwelt 2009a) and recently recorded during the field surveys completed for this assessment occurring within and around the proposed modification areas. Further discussion of the threatened fauna species recorded in the proposed modification areas can be found in **Appendix A** and **B**.

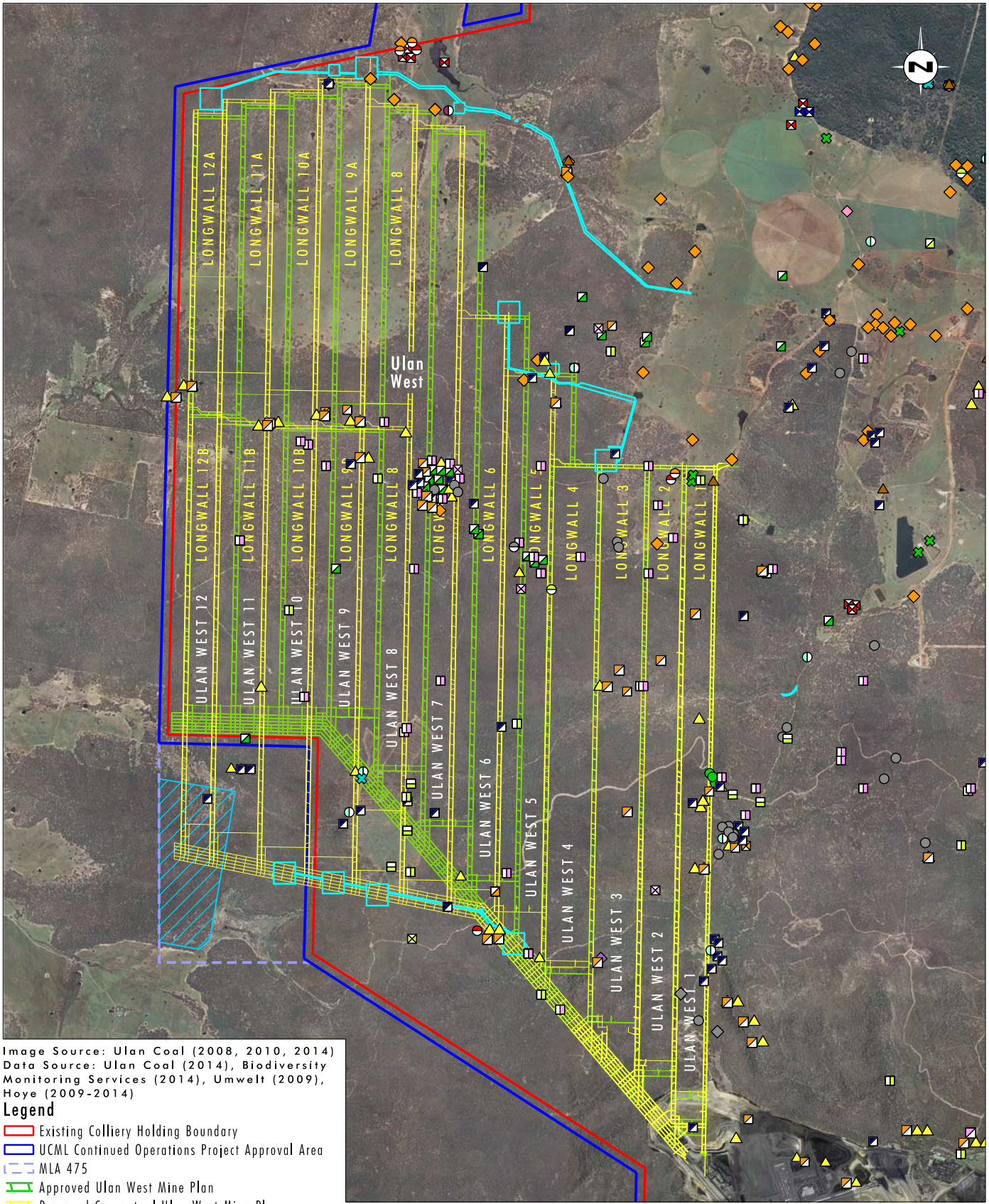


Image Source: Ulan Coal (2008, 2010, 2014)
Data Source: Ulan Coal (2014), Biodiversity Monitoring Services (2014), Umwelt (2009), Hoye (2009-2014)

Legend

- Existing Colliery Holding Boundary
- UCML Continued Operations Project Approval Area
- MLA 475
- Approved Ulan West Mine Plan
- Proposed Conceptual Ulan West Mine Plan
- Proposed Surface Infrastructure Area
- Black-breasted Buzzard
- Black-chinned Honeyeater (eastern subspecies)
- Blue-billed Duck
- Brown Treecreeper (eastern subspecies)
- Diamond Firetail
- Eastern Bentwing-bat
- Flame Robin
- Glossy Black-Cockatoo
- Greater Long-eared Bat (south eastern form)
- Grey-crowned Babbler (eastern subspecies)
- Greater Broad-nosed Bat
- Grey-headed Flying-fox
- Hooded Robin (south-eastern form)
- Koala
- Large-eared Pied Bat
- Large-footed Myotis
- Little Lorikeet
- Little Pied Bat
- Painted Honeyeater
- Powerful Owl
- Scarlet Robin
- Speckled Warbler
- Spotted Harrier
- Squirrel Glider
- Swift Parrot
- Turquoise Parrot
- Varied Sittella
- Yellow-bellied Sheathtail-bat
- *Homoranthus darwinioides*
- Access for Survey not available

0 1.0 2.0 2.5km
1:50 000

FIGURE 4.2

Recorded Threatened Species

File Name (A4): R04/3363_010.dgn
20141211 9.41

4.2.4 Endangered Fauna Populations

No endangered fauna populations occur or are likely to occur within the proposed modification areas.

5.0 Impact Assessment

A number of significant ecological features were recorded or have potential to occur within the proposed modification areas, and therefore have the potential to be impacted by the proposed modification. The following impact assessment addresses those direct and indirect impacts that may result on significant ecological features within the proposed modification areas. Direct impacts, in this case, relate to the removal of vegetation (and associated habitat) for the construction of surface infrastructure facilities. This is the only vegetation that is proposed to be actively removed as part of the proposed modification.

It is likely that potential indirect impacts will be limited to the Ulan West underground mining area, where subsidence-related impacts may include cracking or rock fall along cliff lines, potential tree fall as a result of rock fall and possible changes to surface hydrology.

5.1 Direct Impacts

The proposed modification seeks to alter the existing Approved Surface Infrastructure Area to reposition a number of key features which (while approved) have not yet been constructed, and also to add others not originally approved. **Table 5.1** identifies the total area of each vegetation community that falls within the Proposed Surface Infrastructure Area and compares this to the Approved Surface Infrastructure Area to provide a net change in impact area which is the subject of the current application.

As described in **Section 2.2.2**, there are three potential locations being considered for one of the ventilation shafts that requires construction as part of this proposed modification. The final site for this shaft is yet to be defined, as it will be dependent on the ventilation requirements of the progressing Ulan West longwalls. In relation to direct impacts, **Table 5.1** below provides the maximum and minimum impact range for the relevant communities, taking into account the three potential location options for Main Shaft 2.

For the purposes of this assessment, the highest potential impact that relates to the three options for Main Shaft 2 has been assessed. This has been included in the overall net change values provided in **Table 5.1**. This conservative approach has been adopted to ensure that the maximum impact has been considered throughout this impact assessment.

Table 5.1 – Impacts of Proposed Surface Infrastructure Area Compared to Approved Surface Infrastructure Area

Vegetation Community	Proposed Surface Infrastructure Area (ha)	Approved Surface Infrastructure Area (ha)	Net Change in Area of Impact (ha)
Blakely's Red Gum Open Forest*	5.9	7.3	-1.4
Derived Native Grassland*	2.6	13.6	-11.1
Grey Box Woodland	0.0	0.6	-0.6
Dry Heathland on Rocky Outcrops	0.1	0.0	0.1
Ironbark Open Forest Complex on Sandstone	38.61 – 38.08	18.1	20.51
Ironbark Open Forest Complex on Sandstone (regenerating)	1.0	0.7	0.3
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium	0.18	0.5	-0.32

Table 5.1 – Impacts of Proposed Surface Infrastructure Area Compared to Approved Surface Infrastructure Area (cont)

Vegetation Community	Proposed Surface Infrastructure Area (ha)	Approved Surface Infrastructure Area (ha)	Net Change in Area of Impact (ha)
Rough-barked Apple Open Forest on Alluvium/Colluvium	3.7	4.7	-1.0
Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating)	2.1	2.1	0.0
Scribbly Gum Woodland – Heathland on Sand Plateaux	0.7	0.8	-0.1
Stringybark-Ironbark Open Forest on Sandstone Slopes	1.6	0.6	1.0
Unimproved Pasture	2.1	5.2	-3.1
Water Bodies	0.0	0.2	-0.2
White Box Woodland*	0.0	1.4	-1.4
White Box Woodland (regenerating)*	0.0	0.3	-0.3
Yellow Box - Red Gum Woodland*	0.0	0.3	-0.3
TOTAL	**58.7**	**56.5**	**2.1**

Notes: Values have been rounded up to nearest single decimal place. All values subject to minor mapping/GIS-based discrepancies.
* White Box Woodland TEC variant

It is noted that neither the Approved Surface Infrastructure Area nor Proposed Surface Infrastructure Area considers existing access tracks. There are no changes proposed to these existing tracks, thus they have not been included. These existing access tracks were not recognised in the vegetation mapping for the proposed modification (or for the larger UCCO Project (Umwelt 2009a)), as they were generally smaller than the minimum mappable area adopted.

It is assumed that all vegetation within the Proposed Surface Infrastructure Area will be removed as part of construction. This is considered to be an upper limit in regards to impact, as ancillary infrastructure such as access tracks, pipelines and transmission lines will be co-located or located in already approved disturbance footprints, where possible. These will also be decommissioned progressively (as mining progresses to the west) and, where possible, disturbance footprints will be rehabilitated in accordance with the Ulan Coal Complex's approved rehabilitation strategies as provided in the Ulan Coal Complex Integrated Mining Operations Plan (IMOP) and BMP.

Table 5.1 identifies that the total area of the Proposed Surface Infrastructure Area for proposed modification is up to approximately 58.7 hectares. The Approved Surface Infrastructure Area for the corresponding part of Ulan West is 56.5 hectares, thus making a net difference of approximately 2.1 hectares.

As discussed in **Section 2.4**, there are three potential locations for the Main Shaft 2 ventilation shaft (refer to **Figure 2.1**). The final location of Main Shaft 2 will be dependent on ventilation requirements as Ulan West progresses. As the final location of the proposed ventilation shaft is not known at this time, this assessment has included all three potential ventilation shaft locations (refer to **Figure 2.1**). As such, this conservative approach will overestimate the direct impact associated with the proposed modification.

5.1.1 Vegetation Removal

The proposed modification will involve the removal of all vegetation within the Proposed Surface Infrastructure Area, which relates to a net increase of up to approximately 2.1 hectares of vegetation subject to direct impact. The vegetation communities that will be impacted by the net impact from the Proposed Surface Infrastructure Area includes (in order of decreasing magnitude):

- Ironbark Open Forest Complex on Sandstone (up to approximately 20.51 hectare net impact);
- Stringybark-Ironbark Open Forest on Sandstone Slopes (approximately 1.0 hectare net impact);
- Ironbark Open Forest Complex on Sandstone (Regenerating) (approximately 0.3 hectare net impact);
- Dry Heathland on Rocky Outcrops (approximately 0.1 hectare net impact); and
- Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating) (0.0 hectare net impact).

The remaining vegetation communities listed in **Table 5.1** were originally approved for impact, however will no longer be impacted as a result of the Proposed Surface Infrastructure Area. Of particular importance is the proposed reduction in impact to the White Box Woodland TEC, whereby the existing approval envisaged impact to 22.9 hectares of this TEC compared to the currently predicted impact of approximately 8.5 ha in accordance with the proposed modification. This results in a potential reduction of impact to approximately 14.4 hectares of this TEC. The existing EPBC Approval allows for 69 hectares of White Box Woodland disturbance across the Ulan Coal Complex. The proposed modification will not result in a greater impact to White Box Woodland TEC than that currently approved. UCML will continue to manage their operations in accordance with their EPBC Approval in order to not clear more than 69 hectares of White Box Woodland across the Ulan Coal Complex.

These impacted communities comprise a range of native and introduced flora species that are representative of those occurring in the broader landscape. Ironbark Open Forest Complex on Sandstone is the dominant native vegetation community within the Ulan Coal Complex (over 4,100 hectares), and there has been over 1,000 hectares of Unimproved Pasture mapped in the Ulan Coal Complex (Umwelt 2009a). While less common within the Ulan Coal Complex, the loss of small amounts of the Stringybark-Ironbark Open Forest on Sandstone Slopes, Dry Heathland on Rocky Outcrops and Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating) represents only small proportions of their current extents within the Ulan Coal Complex.

The proposed modification is not likely to result in a loss of native flora species that form these communities such that the biodiversity value of the area will be reduced.

5.1.2 Habitat Loss

The removal of vegetation within the Proposed Surface Infrastructure Area will result in the loss of habitat from a number of formations. These are identified within **Table 5.2**, along with the amount of each formation to be impacted.

Table 5.2 – Impacts of Proposed Surface Infrastructure Area in Relation to Habitat Formations

Habitat Formation	Proposed Surface Infrastructure Area (ha)	Approved Surface Infrastructure Area (ha)	Net Change in Area of Impact (ha)
Forest	53.2	33.9	19.3
Woodland	0.7	3.5	-2.8
Grassland	4.6	18.9	-14.3
Heathland	0.1	0	0.1
Other	0.0	0.2	-0.2
TOTAL	**58.6**	**56.5**	**2.1**

Notes: Values have been rounded up to nearest single decimal place. All values subject to minor mapping/GIS-based discrepancies.

The Proposed Surface Infrastructure Area supports foraging and nesting resources for a range of fauna species, particularly within the forest formation. The formation likely to experience most impact from the Proposed Surface Infrastructure Area will be the Forest formation. This formation will experience an increase in impact (from that already approved) of up to approximately 19.3 hectares of vegetation. The remaining formations will experience a reduced or negligible net chance in impact as a result of the proposed modification.

The key habitat features (in relation to threatened and migratory species) found within the Forest formation include hollow-bearing trees, foraging resources (particularly winter-flowering species) and areas containing cliff lines. Tree hollow density (per hectare) for this formation was recorded at 128, based on field surveys completed by Umwelt (2009a). These are recorded at varying sizes, however almost 75% of these were within the very small (less than 25 millimetres in entrance diameter) and small (26 - 50 millimetres) categories.

Winter-flowering foraging species are of importance to the threatened migratory regent honeyeater (*Anthochaera phrygia*) and swift parrot (*Lathamus discolor*). There are extensive amounts of similar vegetation communities and formations within the Ulan Coal Complex, including its offset areas and corridors.

Cliff lines are of particular importance to cave-dependent micro-bat species. **Section 5.2.1.1** addresses the potential impact to these as a result of the proposed modification. There are large amounts of cliff line within the Ulan Coal Complex which will not be impacted by the proposed modification, including areas within existing offset areas specifically established to protect and manage habitat for these species.

It is unlikely that the habitat features found within the Proposed Surface Infrastructure Area are essential to the survival of any fauna species within the local area. Fauna species utilising the habitat within the Proposed Surface Infrastructure Area would be doing so as part of a wider habitat range, and would not rely specifically or solely on the habitats of the Proposed Surface Infrastructure Area for survival.

Potential subsidence movements within the Maximum Subsidence Affectation Area may result in rock fall within the cliff line areas, as well as the potential loss of small amounts of vegetation associated with rock fall sites. This potential impact is not expected to result in the loss of large amounts of vegetation, nor result in a significant loss in habitat for native fauna species.

The Proposed Surface Infrastructure Area passes through areas of existing native vegetation thus will result in fragmentation of some of the vegetated habitat. While approved levels of fragmentation within Woodland will be reduced as a result of the proposed modification, the Forest habitat will be subject to increased fragmentation impacts to that which is currently approved. This will be in the form of linear fragmentation from pipelines, transmission lines and access tracks, and localised impacts from disturbance areas for ventilation shafts and dewatering boreholes. It is noted that all proposed infrastructure will be progressively decommissioned (where possible) as longwalls are completed and rehabilitated. This will reduce the overall impacts of fragmentation as a result of the proposed modification. The fragmentation impacts as a result of the proposed modification (while operational) will be minor when considering the dimensions of the areas to be cleared and the temporary nature of some of these impacts.

It is not likely that the proposed modification will result in the loss of a significant amount of fauna habitat in the local area.

5.2 Indirect Impacts

5.2.1 Subsidence Impacts

Subsidence can be generically described as the downward movement of the ground surface in response to the rock layers above the coal extraction area temporarily separating and then interfacing again, each one moving down sequentially to fill the gap created by movement of the layer below.

The proposed underground mining operations will result in subsidence above the extracted longwall panels. Subsidence itself does not typically adversely impact on ecological values, however subsidence can lead to surface cracking, rock fall and changes to surface drainage that may impact on ecological values. Notwithstanding this, the subsidence impacts associated with the proposed modification are not expected to result in loss of vegetation in terms of direct tree failure or death.

5.2.1.1 Maximum Subsidence Affectation Area

Detailed subsidence modelling of the Ulan Coal Complex was completed by as part of the UCCO Project EA (Umwelt 2009b). This assessment included detailed predictions of the subsidence associated with UCCO Project and assessment of the potential impacts of subsidence on the built and natural environments (Strata Control Technology (SCT) Operations 2009).

The assessment defined that the area affected by subsidence generally extends above and immediately adjacent to the underground mining footprints (SCT 2009). A further subsidence assessment has been completed for the proposed modification. The subsidence predictions provided as part of the assessment were found to be consistent with previous subsidence levels experienced at the Ulan Coal Complex, including those of the North 1 underground mining area (SCT 2010).

Subsidence predictions for the proposed modification and the potential range of impacts resulting from the predicted subsidence have been extensively monitored and documented by SCT (2014). These predictions indicate that the proposed alteration to the Ulan West mine plan will result in maximum predicted vertical subsidence within a typical range of 0.9 to 1.5 metres, increasing in areas of lower overburden depth, up to about 1.8 metres. These were found to be consistent with previous subsidence predictions for the existing area and

observed subsidence levels experienced at the Ulan Coal Complex, including those of the North 1 underground mining area (SCT 2010).

This is not expected to result in impact to the condition or viability of vegetation communities within the affectation area, based on subsidence-related impacts as predicted in SCT (2014), and consideration of extensive monitoring of previous underground mining.

Impact on Vegetation Communities

The detailed subsidence modelling completed for the proposed modification (refer to above) have identified a Maximum Subsidence Affectation Area. **Table 5.3** identifies those vegetation communities (and the areas of each) located within the Maximum Subsidence Affectation Area. It is noted that this table does not include vegetation within the Proposed Surface Infrastructure Area, as this has been assessed as a direct impact in **Section 5.1** above. Vegetation falling within the Brokenback Conservation Area has also been excluded from this table, as this Conservation Area is protected from subsidence impacts in accordance with the existing Project Approval commitments.

Table 5.3 – Vegetation Communities within Maximum Subsidence Affectation Area

Vegetation Community	Amount within Maximum Subsidence Affectation Area (Ha)
Forest/Open Forest Formation	
Blakely's Red Gum Open Forest	41.4
Blakely's Red Gum Open Forest (regenerating)	29.2
Ironbark Open Forest Complex on Sandstone	1469.2
Ironbark Open Forest Complex on Sandstone (regenerating)	48.7
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium	225.2
Narrow-leaved Ironbark Open Forest on Alluvium/Colluvium (regenerating)	10.8
Rough-barked Apple Open Forest on Alluvium/Colluvium	419.9
Rough-barked Apple Open Forest on Alluvium/Colluvium (regenerating)	36.4
She-oak Low Forest on Sandstone Crests	39.4
Stringybark-Ironbark Open Forest on Sandstone Slopes	104.5
Woodland Formation	
Grey Box Woodland	5.3
Modified White Box Woodland	12.7
Scribbly Gum Woodland – Heathland on Sand Plateaux	164.0
White Box Woodland	83.2
White Box Woodland (regenerating)	25.7
Yellow Box - Red Gum Woodland	12.6
Heathland Formation	
Dry Heathland on Rocky Outcrops	0.6
Narrow-leaved Ironbark Open Forest + Scribbly Gum Woodland – Heathland on Sand Plateaux	202.8
She-oak Low Forest on Sandstone Crests + Dry Heathland on Rocky Outcrops	6.3

Table 5.3 – Vegetation Communities within Maximum Subsidence Affectation Area (cont)

Vegetation Community	Amount within Maximum Subsidence Affectation Area (Ha)
Grassland Formation	
Derived Native Grassland	224.6
Improved Pasture	26.7
Rough-barked Apple Open Forest Grassland	1.1
Unimproved Pasture	131.7
Cleared	
Cleared	0.6
Water Bodies	
Water Bodies	0.8
TOTAL	**3323.4**

Notes: Values have been rounded up to nearest single decimal place. All values subject to minor mapping/GIS-based discrepancies.

There are not expected to be any impacts to the condition or viability of these vegetation communities, based on subsidence-related impacts as predicted in SCT (2014), or as has been observed during extensive ecological monitoring of previous underground mining.

Detailed monitoring surveys of fauna species and habitat values of the vegetation above underground mining areas have been completed by Mount King (now BMS) since 1980, with studies in the Ulan West area commencing in 2006. These surveys have been completed before, during and after underground mining in various locations across the Ulan Coal Complex. The statistical analyses completed on the data collected concluded that:

> there have been no discernible impacts from subsidence upon threatened species, populations, habitats or ecological communities associated with the terrestrial environment (BMS 2013).

Given that detailed subsidence predictions are comparable between these previously mined areas and the currently proposed mining areas (SCT 2014), this conclusion from BMS (2013) is expected to be applicable to the Maximum Subsidence Affectation Area.

Impact on Cliff Lines

The extent of cliff lines across the Ulan Coal Complex and immediate surrounds was identified by a combination of digital elevation modelling, comparison with 1:25,000 series topographical maps, and field observations. Cliffs were defined as being greater than 10 metres in height. A digital elevation model (DEM) was developed based on airborne laser scanning (ALS) survey data of the Ulan Coal Complex and surrounds. Slope analysis of the DEM was used to identify the steeper sections of terrain and estimated heights of these sections. Field observations, height resolution contours and previous mapping of cliff lines on 1:25,000 series topographical maps were used to cross check the locations and heights of the identified cliff lines.

The above cliff line modelling was used to identify the amount of cliff line that may be subject to potential impact as a result of the proposed modification. The probability of impact on these cliff lines was calculated, based on advice from SCT (2014), which provided generic probabilities for rock fall and perceptible impact for cliff lines within each of the five units

within the Triassic sandstone sequence. These predicted rock fall probabilities ranged from 1 to 20 per cent. The assessment of potential impact has taken a conservative approach and assumed a 20 per cent probability of rock fall across all cliff lines within the Triassic sandstone sequences above the Maximum Subsidence Affectation Area.

The cliff formations in the Maximum Subsidence Affectation Area are mainly of relatively low height (i.e. 50 per cent of cliff lines are less than 15 metres high) and are a minor portion of the cliff formations that occur extensively across the region, including in the nearby Goulburn River National Park.

Predicted impacts to cliff line habitat in the Maximum Subsidence Affectation Area are provided in **Table 5.4.** The proposed modification will not impact cliff lines in the Brokenback Conservation Area.

Table 5.4 – Predicted Cliff Line Impacts within Maximum Subsidence Affectation Area

	Modelled Cliff Line Length (m)		
	Proposed Modification	**Approved Development**	**Net Change**
Proposed Surface Infrastructure Area	35.2	105	-69.8
Maximum Subsidence Affectation Area	12,659.4	6,310	6,349.4
Predicted Cliff Line Impact (20%)	2,538.9	1,283	1,255.9

Notes: Values have been rounded up to nearest single decimal place. All values subject to minor mapping/GIS-based discrepancies.

Modelling from Umwelt (2009) has shown that there is a total of 12,659.4 metres of cliff line within the Maximum Subsidence Affectation Area. When applying the 20 per cent probability of rock fall to this area, it is expected that in the order of approximately 2,538.9 metres of cliff line within the Maximum Subsidence Affectation Area may be subject to rock fall impact. This is approximately 1,255.9 metres longer than the currently approved cliff line impact.

Eco Logical Australia (ELA) undertook pre and post-mining monitoring of cliff lines within the Ulan Coal North 1 mining area (longwall panels C, E and F) for evidence of mine subsidence related impacts (ELA 2013). This monitoring was aimed at assessing the appropriateness of the 20% probability value in relation to observable impacts. Monitoring included assessment of cliff lines above the North 1 mining area as well as in control sites for direct comparison. Data was collected pre- and post-mining.

Results of monitoring indicated 60 metres of rock fall had occurred within the North 1 mining area. This was considered a direct result of mining as the control sites were shown to have experienced negligible rock fall. This was the equivalent of 6.0 percent of the total length of cliff line within the North 1 mining area, which was less than the subsidence impact performance measure of 20 per cent. It is anticipated that similar mining-induced subsidence will result from the proposed modification. This monitoring did not identify any vegetation loss as a result of rockfall experienced in this area.

Where rock fall occurs, it is likely that small amounts of vegetation in the immediate area will be damaged, and further damage may be sustained to vegetation below the rock fall area. Previous longwall mining of the Ulan No. 3 Mine has undermined approximately 8 kilometres of sandstone cliffs. It is estimated that approximately 1.6 kilometres (20 per cent) of these

cliff lines have experienced rock falls. This indirect impact, however, has not resulted in the loss of significant amounts of vegetation. It expected that the proposed modification will not alter the level of indirect impact when compared to that observed in the previously mined parts of the mine site.

Rock fall is expected to be most prevalent in weak points in the cliff line, such as existing caves, cracks and overhangs which may provide roosting habitat for cave-dependant micro-bat species. Any vegetation associated with rock fall areas is likely to be damaged; however this impact is likely to be confined to these specific areas only. Subsidence is not expected to cause significant cracking or alteration to hydrology that is likely to be reflected in impacts on vegetation.

Potential Tree Fall

It is expected that subsidence movements as a result of longwall mining will not cause tree fall or failure. This is supported by observations of the previously-mined parts of the mine site, where tree failure as a result of vertical subsidence has not been observed. The cliff line monitoring completed by ELA (2013) did not identify any vegetation loss as a result of rockfall experienced in the Ulan No.3 or North 1 mining areas.

Impacts to Surface Drainage

The Surface Water Assessment (Umwelt, 2014) has determined that the predicted subsidence impacts will result in negligible changes to watercourse stability when compared to the current approved impacts.

In addition to this, the predicted subsidence impacts are deemed to have limited potential to result in increased remnant ponding, both in or out of the drainage lines. Historical and recent site inspections indicate that in the majority of areas where the topographical survey indicates existing remnant ponding, water does not pond in these areas as the soils are sandy and relatively free draining. As such, it is considered unlikely, based on the analysis of the predicted subsidence that any additional remnant ponding will occur within the Maximum Subsidence Affectation Area. This is due to both the steepness of the existing landform and sandy soils.

UCML proposes to continue to monitor second order watercourses for potential subsidence impacts, and if this indicates a need for remediation works these will maintain current channel grades and take into consideration channel stabilities and existing channel characteristics.

If remediation works are required, these have the potential to generate short term water quality impacts while the remediation works are being undertaken and stable vegetated post mining landforms are being achieved. Potential water quality impacts will principally be due to the potential for increased sediment generation and export of sediment off site. To mitigate this potential impact it is proposed to implement a number of erosion and sediment control measures (refer to Surface Water Assessment, Appendix 4 to EA).

The implementation of the proposed erosion and sediment control measures will ensure that underground mining and surface remediation works do not have a significant adverse impact on downstream water users or on downstream ecosystems.

Impacts to Groundwater Dependent Ecosystems

Some of the red gum-dominated riparian communities mapped within the Ulan Coal Complex have the potential to be classified as GDEs, according to the Groundwater Dependent Ecosystem Policy (DLWC 2002) as either:

- wetlands and red gum forests;
- other terrestrial vegetation; or
- ecosystems in streams fed by groundwater.

While there are potentially several examples of these ecosystems throughout the Ulan Coal Complex, these are generally not well-defined, blend into adjacent drier communities and are not significant GDEs such as hanging swamps and limestone cave systems, which are not present in the Ulan Coal Complex. There have been no records of such significant GDEs from ecological surveys completed within the Ulan Coal Complex or proposed modification areas to date. Specialist groundwater studies completed by Mackie Environmental Research (MER) (2011) reports that:

> there are no GDEs within the project area that are likely to be impacted by the loss of formation groundwater.

Red gums have been recorded in specific vegetation assemblages across the proposed modification areas, generally in the red gum/rough-barked apple assemblages, which have been recorded along minor drainage depressions and broad alluvial flats associated with drainage lines. There have been no groundwater-dependent wetlands recorded within the proposed modification areas or broader Ulan Coal Complex.

The majority of the red gum/rough-barked apple assemblages occur along the minor drainage depressions associated with Ulan, Cockabutta, Mona and Brokenback Creeks. However, as part of the regional groundwater monitoring program, a series of piezometers were installed in late 2008 within the upper reaches of Mona Creek and Brokenback Creek to determine the extent of alluvium and presence of groundwater. The results have shown the alluvium to be thin (less than 5 metres) and comprise sandy, silty deposits with limited saturation thickness. Most of the test holes were essentially dry (MER 2011). Such results suggest that these vegetation types are more likely to be reliant on surface runoff than groundwater resources.

5.2.1.2 Impact on Threatened Cliff Line and Cave-Dependent Species

The impact of subsidence on cliff line habitat within the proposed modification areas could potentially involve impacts on cave habitats, and therefore potential impact on cave-dependent species. Current and previous surveys have identified a number of cave-dependent species occurring within the Ulan Coal Complex, including the following threatened micro-bat species:

- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) – cave dwelling, also uses mine entrances and road culverts. Maternity caves are usually found in limestone formations and may number hundreds of thousands of females. Non-breeding colonies occur in sandstone formations, however are generally smaller, and can comprise both sexes;
- large-eared pied bat (*Chalinolobus dwyeri*) – roosts in caves and mines. Also utilise boulder piles and mine tunnels. Maternity caves generally accommodate colonies of up to 50 females, however some colonies can be up to 500 females in size;

- southern myotis (*Myotis macropus*) – roosts in caves, dense vegetation or tree hollows, usually near water. Colonies up to several hundred, more commonly roost in groups of 10 to 15 individuals;

- little pied bat (*Chalinolobus picatus*) – roosts in trees, caves, buildings and abandoned mines. In caves they usually occur in colonies of fewer than 10 individuals; and

- eastern cave bat (*Vespadelus troughtoni*) – cave dwelling, found in sandstone overhangs, boulder piles and mine tunnels. Colonies of up to 50 females, however some colonies can be up to 500 females in size.

Additionally, the brush-tailed rock-wallaby (*Petrogale penicillata*) is reliant on rocky cliff line areas as refuge habitat from predators.

If micro-bat species are breeding or roosting within the cliff lines of the proposed modification areas, there is potential that subsidence-related rockfall could impact on breeding or roosting caves (if present). If so, two scenarios could occur:

- Breeding cave (depending on the timing of the impact) – rockfall could destroy a cave that is suitable for breeding. These are rare in the landscape as they require very specific temperature and microclimate parameters. The loss of such a cave could prevent breeding in the area (or possibly a larger area) if no other suitable caves were present. Pregnant or lactating females and young could be injured or killed, or juveniles left in crèches could be injured or killed (while females are foraging). Such impacts could significantly impact the ability of the local population to breed and persist in the area.

- Roosting cave (depending on the time of year) – may cause injury or death to colonies of males or females (usually roost in single-sex colonies). Such impacts could significantly impact the ability of the local population to breed and persist in the area.

Specialised micro-bat monitoring has been occurring across the Ulan Coal Complex since 1994. This has included monitoring of offset areas, rehabilitation, non-impacted areas and areas subject to underground mining (hence subsidence). Particular attention has been paid to the three cave-dependant species that are regularly recorded throughout the Ulan Coal Complex and are considered potentially vulnerable to underground mining impacts. These are the large-eared pied bat (*Chalinolobus dwyeri*), eastern bentwing-bat (*Miniopterus schreibersii oceanensis*) and eastern horseshoe bat (*Rhinolophus megaphyllus*) (although not threatened is locally significant).

Within the limitations of the works completed thus far, monitoring has not identified evidence of micro-bat species being impacted by subsidence within the Ulan Coal Complex. Further, this monitoring indicates that populations of the three target cave-roosting species appear to be stable (Fly By Night 2014b).

However, this program recommends continued monitoring to gain further data on post-subsidence status of target cave-dependent species as well as to distinguish subsidence induced to naturally occurring fluctuations.

While there is evidence of two confirmed and one highly likely maternity roost for the large-eared pied bat (*Chalinolobus dwyeri*) within the Ulan Coal Complex, these do not fall within the proposed modification areas or Maximum Subsidence Affectation Area. However it is not possible to exclude the possibility of the presence of such caves in the proposed modification areas and Maximum Subsidence Affectation Area. The potential for the eastern bentwing-bat breeding in the Ulan Coal Complex is lower, due to its preference for limestone breeding caves, and its ability to travel relatively large distances.

As there is no way to conclusively exclude the potential for breeding and/or roosting of these species in the cliff lines of the proposed modification areas, this assessment assumes their potential presence, and assesses potential impacts accordingly. The assessment does, however recognise the extensive monitoring works completed for these species (including within the proposed modification areas and Maximum Subsidence Affectation Area) and the lack of current evidence of subsidence-related impacts on populations of these species (Fly By Night 2014b).

5.3 Impacts on Threatened Species, Migratory Species Endangered Populations and Threatened Ecological Communities

5.3.1 Environmental Planning and Assessment Act 1979

The EP&A Act requires a Test for Ecological Significance relating to the potential impacts of the proposed modification on listed threatened species, endangered populations or TECs. An assessment of threatened species, endangered populations and TECs listed under the TSC Act with potential to occur within the proposed modification areas is included in **Appendix B**.

No threatened flora species were recorded within the proposed modification areas during the field survey completed for this assessment; however four were considered to have the potential to occur being Ausfeld's wattle (*Acacia ausfeldii*), painted diuris (*Diuris tricolor*), Cannons stringybark (*Eucalyptus cannoni*), scant pomaderris (*Pomaderris queenslandica*) and *Homoranthus darwinioides*. Each of these species is listed as vulnerable under the TSC Act and was tested for Ecological Significance in accordance with the EP&A Act in **Appendix E**.

Ten threatened fauna species listed under the TSC Act were identified within the proposed modification areas during surveys completed by BMS (2014), and a further 12 have been recorded within the Maximum Subsidence Affectation Area previously (Umwelt 2009a). A number of other threatened fauna species listed under the TSC Act were considered to have potential to be impacted by the proposed modification and were tested for Ecological Significance in **Appendix E**. Due to the nature of the predicted impacts from the proposed modification, those fauna species subject to further assessment focused on those recorded in the vicinity and are dependent on hollows (to be removed as part of direct clearing for the Proposed Surface Infrastructure), are cave-dependent (thus vulnerable to subsidence-related cliff fall) or are habitat specialists. Threatened fauna subject to assessment were the:

- glossy black-cockatoo (*Calyptorhynchus lathami*);
- gang-gang cockatoo (*Callocephalon fimbriatum*);
- little lorikeet (*Glossopsitta pusilla*);
- swift parrot (*Lathamus discolor*);
- turquoise parrot (*Neophema pulchella*);
- powerful owl (*Ninox strenua*);
- barking owl (*Ninox connivens*);
- brown treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);

- regent honeyeater (*Anthochaera phrygia*);
- koala (*Phascolarctos cinereus*);
- squirrel glider (*Petaurus norfolcensis*);
- brush-tailed rock-wallaby (*Petrogale penicillata*);
- yellow-bellied sheathtail bat *(Saccolaimus flaviventris*);
- little bentwing-bat (*Miniopterus australis*);
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*);
- south-eastern long-eared bat (*Nyctophilus corbeni*);
- little pied bat *(Chalinolobus picatus)*;
- large-eared pied bat (*Chalinolobus dwyeri*);
- eastern false pipistrelle (*Falsistrellus tasmaniensis*);
- southern myotis (*Myotis macropus*); and
- eastern cave bat (*Vespadelus troughtoni*).

There are no endangered flora or fauna populations known to occur within the proposed modification areas or considered likely to occur.

One TEC listed under the TSC Act was subject to a Test for Ecological Significance under the EP&A Act, being White Box - Yellow Box – Blakely's Red Gum Woodland EEC. The outcomes of this assessment are provided in **Appendix E**. Of particular importance is the proposed reduction in impact to the White Box Woodland TEC, whereby the existing approval envisages impact to 22.9 hectares of this TEC compared to approximately 8.5 ha as a result of the proposed modification. This results in a reduction of impact to approximately 14.4 hectares of this TEC.

This assessment has been made without consideration of the mitigation, ameliorative or offset measures. Rather, the conclusion on impacts is based purely on the anticipated effects that the proposed modification would have on the ecological features of the area if the proposed modification were implemented without any form of mitigation or offsetting.

While not considered as part of the conclusions to impact assessment, impact mitigation has been developed and included as an integral component of these proposed modification. This follows the same approach to management adopted as part of the UCCO Project Ecological Assessment (Umwelt 2009a), and is discussed in **Section 6.0**.

These assessments determined that the proposed modification is unlikely to result in a significant on threatened flora or fauna species, TECs, or their habitats. This is primarily a result of:

- the relatively minor area of direct impact (being loss of vegetation and fauna habitat within up to approximately 58.7 hectares);

- the negligible indirect impacts expected to occur to vegetation communities and fauna habitat within the Maximum Subsidence Affectation area;

- where impacts to cliff lines are anticipated as a result of subsidence, these are reliably predicted to be less than 20% of cliff lines within the Maximum Subsidence Affectation Area; and

- ongoing ecological monitoring (focusing on fauna, fauna habitat, flora, cliff lines and micro-bats) identifying no evidence (to date) of subsidence-related impacts to fauna assemblages, fauna habitat, vegetation communities and micro-bat populations.

5.3.1.1 SEPP 44 (Koala Habitat) Assessment Results

There are areas of vegetation within the proposed modification areas that consist of 15 per cent or more of Schedule 2 tree species in the upper and lower strata, and consequently provide potential koala habitat. Koalas (*Phascolarctos cinereus*) have been recorded within the Ulan Coal Complex, including a single individual in the proposed modification areas. Only low numbers of this species have been obtained within the Ulan Coal Complex since fauna survey commenced in 1994, however it is possible that these for a very sparse population of this species using the habitats of the Ulan Coal Complex and broader area. This species has been subject to impact assessment at the State and Commonwealth levels in **Appendices E** and **F**, respectively.

5.3.2 Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth EPBC Act, 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:

- listed threatened species and communities;

- migratory species protected under international agreements;

- Ramsar wetlands of international importance;

- the Commonwealth marine environment;

- the Great Barrier Reef Marine Park;

- world heritage properties;

- national heritage places;

- nuclear actions; and

- a water resource in relation to coal seam gas development and large coal mining development.

A search of the Department of the Environment (DoE) Protected Matters Search Tool identified (discounting fishes and marine species) a number of TECs, threatened species and migratory/marine species listed under the EPBC Act that have the potential to occur within

10 kilometres of the proposed modification areas. Each of these is included within **Appendix B**, which determines whether the species warrants further assessment by way of an Assessment of Significance. This Appendix determined that an Assessment of Significance was required for the following eight threatened species, one migratory species and one CEEC:

- hoary sunray (*Leucochrysum albicans* var. *tricolor*);
- *Homoranthus darwinioides*;
- swift parrot (*Lathamus discolor*);
- regent honeyeater (*Anthochaera phrygia*);
- koala (*Phascolarctos cinereus*);
- brush-tailed rock-wallaby (*Petrogale penicillata*);
- south-eastern long-eared bat (*Nyctophilus corbeni*);
- large-eared pied bat (*Chalinolobus dwyeri*);
- rainbow bee-eater (*Merops ornatus*); and
- White Box – Yellow Box Blakely's Red Gum Woodland and Derived Native Grassland CEEC.

The EPBC Act lists criteria which are used to determine whether an action is likely to have a significant impact on MNES. These criteria are addressed in the Assessment of Significance provided in **Appendix F**. The Assessments of Significance completed for the eight threatened species, one migratory species and one CEEC concluded that the proposed modification was unlikely to result in a significant impact.

5.4 Impacts on Critical Habitat

There are four areas of Critical Habitat declared under the TSC Act, these being:

- Cabbage Tree Island, Port Stephens, Critical Habitat for the Gould's Petrel (*Pterodroma leucoptera leucoptera*);
- North Sydney Harbour, Critical Habitat for the Little Penguin (*Eudyptula minor*);
- Stotts Island Nature Reserve, Critical Habitat for the Mitchells Rainforest Snail (*Thersites mitchellae*); and
- Wollemi National Park, Critical Habitat for the Wollemi pine (*Wollemia nobilis*).

While parts of the northern borders of Wollemi National Park lie approximately 20 kilometres to the south of the proposed modification area, the proposed modification will not impact on the areas recommended for declaration or declared as critical habitat for the Wollemi Pine (*Wollemia nobilis*).

5.5 Key Threatening Processes

There are currently a number of key threatening processes (KTPs) listed under the TSC Act, EPBC Act and the FM Act. Of these, a number have been discounted from this assessment, due to their irrelevance to the proposed modification. In general, the proposed modification is likely to or might cause an increase in the incidence of the following KTPs within the proposed modification areas:

- alteration of habitat following subsidence due to longwall mining (listed under the TSC Act) – however a long history of underground mining at the Ulan Coal Complex has shown minimal ecological impact from this KTP;
- Bushrock removal (TSC Act) – from clearing activities in the Proposed Surface Infrastructure Area;
- Clearing of native vegetation (TSC Act and EPBC Act) – from clearing activities in the Proposed Surface Infrastructure Area;
- Anthropogenic climate change (TSC Act, FM Act and EPBC Act);
- Loss of hollow-bearing trees (TSC Act) – from clearing activities in the Proposed Surface Infrastructure Area; and
- Removal of dead wood and trees (TSC Act) – from clearing activities in the Proposed Surface Infrastructure Area.

It is not anticipated that the extent of influence from the proposed modification on any of these KTPs will be significant.

6.0 Impact Mitigation Measures

This section describes the impact mitigation strategy that has been developed to ameliorate the impacts of the proposed modification on threatened species, endangered populations, TECs and their habitats. The primary approach to this has been to initially avoid ecological impact. Where such an impact has been unavoidable, attempts have been made to minimise impacts, and then provision has been made to offset those unavoidable impacts. This section discusses the measures included in the design of the proposed modification to avoid and minimise ecological impacts.

6.1 Measures to Avoid and/or Minimise Ecological Impact

UCML has sought to firstly avoid and then minimise potential impacts on the ecological values of the proposed modification areas throughout the project planning process, where possible. A number of strategies have been adopted to avoid or minimise ecological impact as part of the project design phase, these being:

- Alteration to the originally proposed layout of the Proposed Surface Infrastructure Area (as much as feasible) in order to avoid areas of White Box Woodland TEC. This was completed in a number of phases throughout the project design phase, with infrastructure overlain on vegetation mapping and where possible, infrastructure moved to avoid areas of White Box Woodland TEC. Priority was placed on avoiding the treed variants of White Box Woodland TEC where possible, with impact focused on grassland variants where impact to the TEC was unavoidable in certain areas;

- Where moving infrastructure was not possible (due to need for it to be located according to the underlying longwalls), the size of the disturbance footprint for the pipelines, transmission lines, access tracks, ventilation shafts etc. was minimised as much as possible. Infrastructure will be co-located as much as possible to minimise disturbance footprints;

- Existing access tracks were used as much as possible in the project planning; and

- Progressive decommissioning and rehabilitation of infrastructure as longwall mining progresses.

The proposed modification has been designed in a manner that aims to avoid disturbance to the ecological features of the proposed modification areas where possible, whilst maintaining the economic feasibility and practicality of all components of the proposed modification.

The area to be disturbed for the proposed modification largely consists of cleared areas and grassland. Where impacts on ecological features were deemed unavoidable, an impact mitigation strategy was prepared that addresses the mitigation of these impacts in the long term.

6.2 Impacts to be Mitigated

The loss of up to approximately 58.7 hectares of vegetation within the Proposed Surface Infrastructure Area is not likely to result in significant impacts on the biodiversity of the local area, particularly as it relates to only an approximately 2.1 hectare increase to that which is already approved. In addition, there is negligible impact expected to occur to the

approximately 3323.4 hectares of vegetation within the Maximum Subsidence Affectation Area, based on subsidence predictions and ecological monitoring completed in these areas.

The proposed modification is likely to result in damage to up to approximately 2538.9 metres of cliff line habitat within the Maximum Subsidence Affectation Area, thereby potentially impacting on cliff line dependent species within that area. This equates to an increase of 1255.9 metres of potentially impacted cliff line.

It is appropriate to implement mitigation measures for those impacts that have not been able to be avoided and have potential to occur as a result of the proposed modification.

6.3 General Mitigation Measures

The following general mitigation measures will be implemented (as much as possible), in order to minimise impacts resulting from the proposed modification:

- maximise the use of existing disturbed areas within the proposed modification areas for the placement of infrastructure and to avoid impact on surrounding vegetation;
- implementation of a detailed pre-clearing and tree felling supervision program for Proposed Surface Infrastructure Areas. This will follow the existing procedures currently implemented by UCML under the current BMP;
- installation of nest boxes to replace the hollow lost as a result of the clearing activities. An accurate record of hollows in the Proposed Surface Infrastructure Area will be obtained during the pre-clearing process, and these will be replaced with nest boxes of comparable design (based on hollow size class recorded). Nest boxes will be installed in nearby secure habitats to compensate for hollows lost as a result of the proposed modification. These nest boxes will be subject to the detailed monitoring and maintenance program that is currently being implemented as part of the BMP; and
- current weed management and feral fauna management activities (being completed as part of the BMP) will cover the areas subject to the proposed modification.

6.4 Monitoring

The proposed modification areas will be subject to the same degree of ecological monitoring as the remainder of the Ulan Coal Complex, as per the requirements of the BMP. This will include monitoring methods that:

- provide a good indication of the status of the environmental value that UCML aims to protect;
- are relatively simple to measure and are reproducible; and
- are cost effective.

A detailed monitoring program for the broader Ulan Coal Complex has been developed and described within the BMP, and comprises:

- micro-bat monitoring of rehabilitation, offset areas, subsidence impacts and the broader Ulan Coal Complex;

- general fauna and fauna habitat monitoring across the rehabilitation, offset areas, subsidence impacts and the broader Ulan Coal Complex;

- cliff line monitoring above longwall mining areas;

- floristic monitoring of the Ulan Coal Complex, including areas of rehabilitation, offset areas and subsidence impacts.

This monitoring covers a range of techniques (and purposes), and all will be extended (where necessary) to include monitoring of the anticipated impacts resulting from the proposed modification. Particular emphasis should be placed on the monitoring of micro-bats and cliff line habitats within the proposed modification areas to strengthen the current confidence in the accuracy of predicted subsidence impacts and evidence of micro-bat impact. General flora and fauna monitoring should continue to be completed on a regular basis, as per the BMP.

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