DRAFT REPORT

Central West Coal Project

Progressive Rehabilitation Plan

Prepared for

Central West Coal Pty Ltd

Suite 4, Level 3, South Shore Centre
83-85 The Esplanade
South Perth WA 6151

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Central West Coal Pty Ltd (a wholly owned subsidiary of Aviva Corporation Limited [Aviva]) proposes to develop the Central West Coal Project (the Project) located approximately 15 km south-west of Eneabba, in the Mid-West region of Western Australia (WA) (Figure 1-1). The Project is based on the mining of the Central West Coal Deposit as an energy source for the adjacent proposed Coolimba Power Station (Figure 1-2). The resource comprises a 75 million tonne (Mt) sub-bituminous coal deposit approximately 12 km long and ranging from 0.3-2.0 km wide.

Central West Coal Pty Ltd secured access to the deposit in May 2004 when Central West Coal Pty Ltd signed a binding Heads of Agreement for an option to purchase the rights to the Project from Sword Nominees Pty Ltd. The coal was discovered by Sword Nominees Pty Ltd during the 1960's, while drilling a windmill bore. Sword Nominees Pty Ltd applied for coal mining leases and entered into agreements with Goldfields Exploration Ltd in 1979. Meanwhile, other companies were exploring the area for Mineral Sands. In 1988 RGC Limited, the parent company of Goldfields Exploration Ltd, acquired the mineral sands tenements. The coal and mineral sands tenements were then combined into the current State Agreement Mining Lease M267SA, with Sword Nominees Pty Ltd retaining rights to the coal resource.

The Coolimba Power Station is a related project proposed by Coolimba Power Pty Ltd (a wholly owned subsidiary of Aviva). Coolimba Power Pty Ltd proposes to construct a 450 megawatt (MW) coal fired power station (Figure 1-2).

The main components of the proposed Project (Figure 1-3) comprise:

- Open cut mine;
- Waste dump;
- Mine backfill with co-disposal of coal combustion ash and saline residue;
- Stockpile management corridor (SMC);
- Run-of-Mine (ROM) pad;
- Coal handling plant and coal stockpiles;
- Access roads;
- Raw water storage dam
- Dewatering bores and associated pipelines;
- Laydown areas;
- Workshop;
- Stores
- Fuel storage;
- Borrow pits;
- Landfill; and
- Administration offices.

Section 1 Introduction

Mining will occur progressively and will comprise an open-cut strip mine to extract approximately 2 to 2.5 million tonnes per annum (Mtpa) of sub-bituminous coal. Based on the current estimate of reserves, the anticipated life of the mine is 30 years.

The mine will progress along the orebody and with a disturbed open area of approximately 120 ha at any one time, with a continual backfill and progressive rehabilitation programme. Overburden will be transported to the waste dump to be used to backfill the pit. The coal will be trucked to the ROM area, crushed, screened and stockpiled ready to be conveyed to the power station.

The proposed Project is being assessed as a Public Environmental Review (PER). Due to a bilateral agreement between the State and Commonwealth governments, the PER serves as the environmental assessment document under both the State *Environmental Protection Act* 1986 and the *Commonwealth Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

This document is a draft Progressive Rehabilitation Plan for the Project. It has been prepared using a range of baseline studies, literature reviews and stakeholder consultation. The plan is appended to the PER to provide regulators, members of the public and other stakeholders with information on how Central Coal West Pty Ltd proposes to rehabilitate areas disturbed by the Project and to receive feedback from these stakeholders. The plan will be finalised with consideration of stakeholder comments and input.

The project area includes previously cleared land with areas of native vegetation and rehabilitated native vegetation. The current land uses in the project area include farming, mineral sand mining and mineral exploration. The areas surrounding the project area comprise farming land, nature reserves and mineral sand mining. CWC intends to restore disturbed land to either farming land or native vegetation.

This Progressive Rehabilitation Plan outlines CWC's strategy for returning the areas disturbed by mining operations to the final land use. The major objectives are:

- Minimise the amount of cleared area at any one point in time by carefully planning clearing programs to defer clearing and to commence progressive rehabilitation as soon after mining activities are complete as reasonably possible.
- Ensure that the rehabilitated landform is visually and functionally similar to the surrounding undisturbed area.
- Ensure that surface water infiltration rates of rehabilitated surfaces and the reconstructed soil profile are similar to that of the pre-disturbance landform.
- Revegetate the surface with endemic native flora or with pasture consistent with former land use.
- These objectives are consistent with those recommended by the Environmental Protection Agency (EPA) Best Practice module *Rehabilitation and Revegetation* guidelines (Ward, 1995).

3.1 Environmental Characteristics

3.1.1 Overview

CWC recognises that the EPA and other land management agencies require assurances that the Project will rehabilitate the project area and will minimise adverse environmental impacts. CWC has conducted a range of studies to provide a detailed understanding of the existing environment within the project area and the likely issues involved with the proposed mining operations and the rehabilitation of the project area.

Detailed information regarding the existing environment of the project area is provided in the PER. However, a summary of the environmental factors associated with the rehabilitation of the proposed mining operations is provided below.

3.1.2 Climate

The area experiences a Mediterranean climate of hot, dry summers and mild winters.

Regular weather observations are available for Eneabba, 15 km north of the project area (BoM, 2008b).

Mean maximum monthly temperatures range from 19.6˚C (July) to 36.1˚C (February). Mean minimum monthly temperatures range from 9.0˚C (August) to 19.5˚C (February).

Mean annual rainfall is 504mm over 60.5 rain days. The highest and lowest mean monthly rainfall of 104mm and 7mm occurs in June and January respectively. Annual evaporation is approximately 2400mm.

3.1.3 Soils

The soils present in the project area are the result of a complex geomorphic history. Many of the soils have been strongly influenced by erosion of laterites on the Gingin and Dandaragan Scarps and their subsequent deposition on the coastal plain in outwash fans and extensive channel deposits. These materials have then been buried by fluvial and aeolian sands. Ferricretes form a major component of the project area, occurring as both exhumed and buried masses (D. C. Blandford, pers. comm.).

The soils of the project area generally fall into two main types; texture contrast profiles and deep siliceous sands. The deeper sands, which grade into material with increased clay contents at depth, are associated with aeolian sheet sand deposits. These sands generally have a single grain fabric. Pisolitic to nodular ferricrete is present in many of the profiles at varying depths below the surface where the relationship of the gravels to the containing sandy matrix suggests a fluvial origin. Such an observation is consistent with similar deposits elsewhere on the Eneabba Sand Plain (D. Blandford, pers. comm.). The deeper sands have a neutral topsoil pH range of 6.5 to 7.5.

The texture contrast soils are characterised by a sandy A horizon overlying a clay B horizon. The sandy A horizons range in depth from less than 0.30 m to 1.20 m. Spontaneous dispersion is present in many of the clay subsoils. Spontaneous dispersion is addressed in the materials handling and rehabilitation section of the EMP and Sections 7.6.

Topsoils within the project area are generally chemically and physically infertile. Nitrogen is deficient, phosphorus and potassium levels are low, and organic carbon levels are low (<1%) at six sites, and moderate (1-2%) at four sites. The pH of soils across the project area ranges from 6 (slightly acid) to 8.5 (strongly alkaline) (D. Blandford, pers. comm.). These characteristics are important for the Project in terms of what will be required when the project area is rehabilitated and how the soil quality may be maintained during storage.

Weathering ferricrete and the associated elevated clay content within the soil profiles indicates good water holding potential for vegetation use. This elevated clay content forms an impeding layer to the vertical drainage of surface infiltration which, across the site, ranges from a low of 110 mm/h to a high of 1,404 mm/h (URS, 2009a). Such a range is normal for locations within the Eneabba Sand Plain.

Dispersive surface soils are not uncommon in the Swan Coastal Plain, and are expected within the project area (D. C. Blandford, pers. comm.).

3.1.4 Geochemical Assessments

Overburden, coal combustion ash and saline residue will be used to backfill the pit. Top-soil and other suitable sub-soil will be recovered ahead of mining and used to re-instate a soil profile suitable to support revegetation of the disturbed areas. Overburden and coal combustion ash were geochemically characterised by Terrenus Earth Sciences (Terrenus [2008]) and are discussed in further detail below. Soil characterisation was also undertaken by D C Blandford and Associates Pty Ltd (Blandford, 2008), also discussed below.

Overburden

Over 80% of the waste material samples tested have been classified as non-acid forming (NAF), with a further 8% classified as uncertain-NAF. The remaining 10% are classified as potentially acid forming (PAF).

The results from the waste materials indicate that:

- The overburden is likely to be relatively benign generating pH-neutral and low to moderately saline runoff and seepage following surface exposure.
- Over half of the overburden material is expected to have very low total sulphur content and can be classified as barren.
- The risk of acid generation is expected to be low given the general lack of oxidisable sulphur content.
- The concentration of metals in overburden materials (solids) are within the applied guideline criteria for soils.
- The concentration of soluble metals and salts in runoff and seepage from overburden is likely to remain well within the applied water quality guideline criteria.
- All overburden materials tested are strongly sodic, with significant exchangeable cation imbalances.

Coal Combustion Ash

Coal combustion ash will be generated as a waste stream from the power plant. As the ash waste samples for the assessment were generated from a pilot process, the operational ash materials may have different geochemical characteristics. It is therefore important to note that the assessment should be considered indicative only. The coal combustion ash testing indicated the following:

- The ash is expected to generate alkaline and relatively low-salinity runoff/seepage following surface exposure.
- All of the ash samples tested were NAF.
- The solid ash materials are expected to have total metals and nutrient concentrations (in solids) well below the applied guideline values.
- Leachate from coal combustion ash is likely to contain some dissolved metals in concentrations that may exceed the applied water quality guidelines. The key metals of concern are arsenic (As), boron (B), chromium (Cr), copper (Cu), molybdenum (Mo), selenium (Se) and zinc (Zn).

Soil Characterisation

Eighteen soil inspection pits were excavated at locations to give a representative range of profiles across the ore-body, adjacent lands and to develop an understanding of the near-surface palaeo channel characteristics. (Blandford, 2008)

Soils exhibiting spontaneous dispersion were present at a number of sites. The levels of spontaneous dispersion observed indicate that this aspect of landform and profile re-construction can be managed using standard approaches. However, the presence of dispersive topsoils demonstrating post compaction deflocculation introduces further complexity with rehabilitation planning and design.

The project area soils are dominated by profiles containing weathering ferricrete. These profiles are capable of holding large volumes of meteoric water in the undisturbed state and it will be important that similar characteristics are maintained in re-constructed profiles as part of rehabilitation strategies and management protocols.

3.1.5 Hydrogeology

Superficial formations of Quaternary and Tertiary deposits cover the project area. Underlying the superficial formations is the semi-confined Cattamarra Coal Measures (CCM) aquifer.

The superficial formations consist mainly of silt, sand and clay and form an unconfined aquifer system.

The groundwater flow system is bound by the Indian Ocean in the west and by the Gingin Scarp to the east. Upward leakage by discharge from the CCM into the flow system takes place in the coastal area and locally. Throughflow and upward leakage also occurs from the Yarragadee Formation across the Warradarge Fault (URS, 2006a).

Groundwater levels in the project area reflect regional groundwater gradients, seasonal and long-term climate changes, groundwater abstraction and land clearing. Limited salinity data prior to 1990 suggest that land clearing has resulted in both local and regional increases in groundwater levels (Northern Agricultural Catchments Council [NACC], 2002).

In the project area, groundwater levels are approximately 7 - 12 m below ground surface (URS, 2006a), and water quality associated with the superficial aquifer ranges from fresh/brackish to saline.

3.1.6 Surface Water

A north-south chain of wetlands perched on aoelian sands, including Lake Indoon and Lake Logue are located to the northwest of the project area. The Lake Logue-Indoon System is listed on the Directory of Important Wetlands in Australia.

Lake Logue is a large seasonal freshwater lake and lies within the Lake Logue Nature Reserve. Lake Indoon is a permanent brackish lake within a recreation reserve.

The project area lies within the Lake Indoon catchment, which is drained by the ephemeral Erindoon Creek, Bindoon Creek and an un-named creek. A number of tributaries of Erindoon Creek will be temporarily intersected by the mine until backfilling and rehabilitation restores them, and another small tributary obstructed by the waste rock dump will be permanently diverted to Bindoon Creek.

3.1.7 Flora and Vegetation

The following 14 plant communities were recorded in the project area, with the remaining areas consisting mainly of cleared paddocks, with localised remnant trees:

- **H1** - Mixed heath of *Melaleuca leuropoma* with emergent *Banksia* species with occasional *Eucalyptus todtiana* and *Actinostrobus arenarius* on sand with exposed lateritic rises.
- **H2** - Heath or low shrubland of *Conospermum triplinervium, Verticordia nitens, Adenanthos cygnorum, Stirlingia latifolia* and *Jacksonia floribunda* on sand.
- **H3** - Heath or scrub of *Melaleuca leuropoma, Banksia sphaerocarpa* var*. sphaerocarpa, Dryandra nivea* subsp. *nivea, Eremaea beaufortioides* var. *lachnosanthe* and *Hibbertia subvaginata* on lateritic rises.
- **H4** - Mixed heath of Proteaceae and Myrtaceae spp. with occasional *Eucalyptus todtiana* on sand.
- **H5** - Mixed heath or shrubland of *Xanthorrhoea drummondii, Allocasuarina humilis* and *Hibbertia* spp. and Proteaceae spp. on lateritic uplands.
- **T1** - Scrub or thicket of *Banksia attenuata, Banksia menziesii over Banksia sphaerocarpa var. sphaerocarpa, Adenanthos cygnorum, Banksia hookeriana* and *Conospermum triplinervium* on sand.
- **T2** - Thicket or scrub of *Acacia blakelyi* over *Melaleuca leuropoma, Banksia sphaerocarpa* var. *sphaerocarpa, Verticordia densiflora* var. *densiflora* on sand.
- **T4** - Thicket or scrub of *Melaleuca rhaphiophylla* and *Melaleuca lanceolata* over sedges and rushes on low-lying sandy loams.
- **E1** - Low woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over *Adenanthos cygnorum, Eremaea beaufortioides* var. *lachnosanthe, Melaleuca leuropoma, Banksia sphaerocarpa* var. *sphaerocarpa* and *Hibbertia hypericoides* on sand.
- **E4** - Open low woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over *Banksia menziesii* and *Stirlingia latifolia* on sandy drainage lines.
- **E5** - Open low woodland of *Eucalyptus todtiana, Nuytsia floribunda* over *Banksia menziesii* and *Conospermum triplinervium* on sandy uplands.
- **E6 -** Open low woodland of *Eucalyptus todtiana* and *Nuytsia floribunda* over mixed low shrubs and herbs on sandy lowlands.

- **S1** - Open scrub of *Acacia blakelyi* and *Hakea psilorrhyncha* over *Gahnia trifida, Melaleuca leuropoma, Conostylis aculeata* subsp. *breviflora, *Ursinea anthemoides, *Trifolium campestre* and **Vulpia bromoides* on rehabilitated land.
- **S2** - Open scrub of *Acacia blakelyi* with occasional *Eucalyptus todtiana* over annual grasses and herbs.

* These are weed species.

All of these communities extend outside the project area, but the extent of these communities in the region have been modified by agricultural activities and mining activities. A number of communities are classed as regionally or locally significant. These include; T1, E1, E2, E4, E6, H1, H2, H3, H5, T2, T3, S1, S2, T4. All of these communities are represented in either the Tathra or Eridoon vegetation systems.

A total of four Priority 2, eight Priority 3 and four Priority 4 taxa were recorded within the project area. These comprise:

- *Acacia lasiocarpa* var. *lasiocarpa* Cockleshell Gully variant (E A Griffin 2039) (P2).
- *Calytrix purpurea* (P2).
- *Comesperma rhadinocarpum* (P2).
- *Verticordia argentea* (P2).
- Acacia flabellifolia (P3).
- *Calytrix superba* (P3).
- *Grevillea biformis* subsp. *cymbiformis* (P3).
- *Haemodorum loratum* (P3).
- *Hemiandra* sp. Eneabba (H. Demarz 3687) (P3).
- *Mesomelaena stygia subsp. deflexa (*P3).
- *Schoenus griffinianus* (P3).
- *Verticordia fragrans* (P3).
- *Calytrix eneabbensis* (P4).
- *Stylidium aeonioides* (P4).
- *Georgeantha hexandra* (P4).
- *Verticordia aurea* (P4).

A substantial proportion of the survey area has been burnt recently and this may have influenced the coverage of flora. Some species may have been impacted by fire and some opportunistic species were recovered in sampling after the fires. The condition of the vegetation (based on the Bush Forever condition ratings) ranges from completely degraded in the pastures to excellent in the bushland areas.

3.1.8 Dieback

Three discrete infestations of *P. cinnamomi* have been identified within the project area, and one was also noted adjacent to the project area. These were identified by Glevan in work undertaken for Iluka

Resources Ltd within the Eneabba West Mine area, which the project area overlaps. A further survey by Glevan in December 2007 for CWC found no further infestations within the project area.

The long-term average annual rainfall for the project area is 504mm, and data over the last seven years ranges from 489 mm maximum in 2003 to 307 mm minimum in 2007. This indicates that the project area may be susceptible to, but likely marginal to the survival of, *Phytophthora Cinnamomi* and other 'dieback' pathogens. It would therefore be expected that the disease expression throughout the project area would be episodic rather than the progressive disease expression observed in areas of higher rainfall. This expression may be also be emphasized by localised conditions, such as water gaining sites or areas with a higher water table (Glevan Consulting [Glevan], 2007).

3.1.9 Fauna

Vertebrate Fauna

A total of 11 native mammal species, 31 bird species and 25 herpetofauna species were identified during fauna surveys.

Two species known to occur in the vicinity of the project area are protected under the EPBC Act, Carnaby's Black Cockatoo *(Calyptorhynchus latirostris)* and the Rainbow Bee-eater *(Merops ornatus).*

Two species identified in the project area are gazetted under the *Wildlife Conservation Act* 1950, the Black-striped Snake *(Neelaps calonotus)* and the Rufous Field Wren *(Calamanthus campestris montanellus)*.

A further ten vertebrate species likely to occur in the project area are gazetted under the Department of Environment and Conservation (DEC) Priority Fauna List. These are described in Table 3.1.

Habitats of Significance

Approximately half of the project area contains remnant native vegetation, while the other half is disturbed land considered to be of little value as fauna habitat. No particularly significant individual habitat was located within the project area.

Table 3.1 Potentially Occurring Fauna

Common Name	Scientific Name	Conservation Significance	Description
Australian Bustard	*Ardeotis australis*	DEC Priority 4	Australian Bustards are large nomadic birds that utilise a number of open habitats, including heathlands in the south of WA. There are no recent records of the Australian Bustard from Eneabba; however, there are a number of historical records in the region. It is possible that the species could use the open vegetation, particularly the cleared agricultural land and regenerating heath, within the project area and the adjacent SENR.
White-browed Babbler	*Pomatostomus superciliosus ashbyi* - western wheatbelt subspecies	DEC Priority 4	This species is most often found in thickets of mulga, wattle and acacia as well as uncleared road verges in farmlands, and more than 50% of its former habitat has been cleared for agriculture. The White-browed Babbler has been previously recorded in the region. No suitable habitat was identified within the project area, although vegetation with sufficient structural complexity was observed nearby.
Crested Bellbird	*Oreoica gutturalis*	DEC Priority 4	The Crested Bellbird is listed as a conservation significant species due to the contraction of its current range to less than 50% of its past distribution. Crested Bellbirds have frequently been recorded in the region, and in the Eneabba area occur on open banksia scrubs and heathland. Crested Bellbirds are likely to occur in the few parts of the project area that have adequate trees and shrubs, and are less likely to occur in very open, largely treeless areas and in SENR.
Brush Bronzewing	*Phaps elegans*	DEC Priority 4	Formerly widespread across the south-west of WA, the Brush Bronzewing is now locally extinct across much of this range. This species prefers dense shrublands with significant vertical vegetation structure and access to water, which is not found within the project area. However, records exist of Brush Bronzewings in the nearby Iluka mine site and Southern Beekeepers Reserve.
Hooded Plover	*Charadrius rubricollis*	DEC Priority 4	Hooded Plovers are restricted to coastal areas, estuaries and salt lakes and were recorded at Eneabba in 2006. However, they are not expected to occur within the project area due to a lack of suitable habitat.
Fork-tailed Swift	*Apus pacificus*	EPBC Act Migratory	Fork-tailed Swifts are a migratory species that spends winter in Australia after breeding in Mongolia and China. Fork-tailed Swifts have previously been recorded from the Lesueur area and are attracted to thunderstorms. Due to the aerial lifestyle and migratory nature of this species, it is expected to be an infrequent visitor and would not directly utilise the fauna habitats of the project area.

Table 3.1 (continued)

Common Name	Scientific Name	Conservation Significance	Description
Peregrine Falcon	*Falco peregrinus*	*Wildlife Conservation Act 1950* Schedule 4	The Peregrine Falcon breeds on all continents except Antarctica. Australia is considered one of the strongholds of the species, as numbers have declined in many other parts of the world. Peregrine Falcons commonly prefer cliffs along the coast, rivers, ranges, wooded watercourses and lakes, and will nest primarily on cliff ledges, granite outcrops and in quarries. Peregrine Falcons have been recorded in the region. No potential breeding sites are present in or near the project area but the species may utilise the project area for foraging.
Eastern Great Egret	*Ardea alba*	EPBC Migratory	The Eastern Great Egret are most commonly found in both fresh and saline shallow waters neither of which are found in the project area. This species has been recorded in the region, but due to a lack of suitable habitat it is unlikely to be present in the project area.
Woma	*Aspidites ramsayi* (south-west population)	*Wildlife Conservation Act 1950* Schedule 4; DEC Priority 1	The Woma python is a moderately large snake that prefers woodlands, heaths and shrublands on sandplains. Several populations have been identified across Australia, including the south-west population, which has a range that covers the project area. However, this population has not been recorded since 1989. Clearing of much of its natural habitat and predation by foxes and cats has resulted in a major population decline. Suitable habitat in the form of heath on sand plains is present within the project area, but due to its scarcity and the prevalence of introduced predators in the project area, it is unlikely to be present.
Gilled Slender Blue-tongue	*Cyclodomorphus branchialis*	*Wildlife Conservation Act 1950* Schedule 1; DEC Vulnerable	The Gilled Slender Blue-tongue is a large skink found in semi-arid shrublands in an area between the Murchison and Irwin Rivers. This species has also previously been recorded in the area. Due to the close proximity of these records and the suitable habitat in the project area, it is likely that the Gilled Slender Blue-tongue could potentially occur. However, if a population is present, it is likely this would have experienced a large population decline due to the large-scale burn in 2005.

Source: ecologia (2008)

Short Range Endemic Invertebrates

Two SRE invertebrate surveys were conducted over the Project and adjacent areas, using conventional trapping and foraging techniques. The surveys revealed five Arthropod orders. Three species of conservation significance were collected both within and outside areas that will be disturbed. These were an undescribed species of scorpion from the *Urodacus* genus, an unknown species of *Bothryembrion* snail and an unknown species of millipede from the *Antichiropus* genus.

Stygofauna

A total of 96 samples collected from both the superficial aquifer and the deeper aquifer of the underlying CCM yielded only one known stygobitic taxon, the undescribed Syncarida, Bathynellidae sp. 1. No stygofauna were recovered from the bores known to access the deeper formation. Given the sampling intensity employed for the investigation, the aquifers of the project area are not considered to contain a diverse stygobitic fauna. A risk assessment concluded that there was strong morphological evidence that the species range extends outside of the project area (Bennelongia, 2008)

Troglofauna

The potential for the presence of troglofauna within the project area is dependent upon suitable habitat, determined by the geology and geomorphology. Suitable subsurface cavities for troglofauna habitat are unlikely to be developed in unconsolidated fine sands. While subsurface cavities may develop by piping processes in unconsolidated sediments, such cavities are typically short-lived and of highly localised extent, and thus unlikely to provide suitable long-term habitat for troglofauna (Subterranean Ecology, 2007).

3.1.10 Pests and Weeds

Four introduced mammal species were recorded within the project area. These were the fox (*Vulpes vulpes*), cat (*Felis catus*), rabbit (*Oryctolagus cuniculus*) and house mouse (*Mus musculus*).

Twenty taxa recorded by Mattiske within the flora and vegetation survey area are introduced species. None of these introduced species are listed under Section 37 of the *Agriculture and Related Resources Protection Act 1976.*

3.2 Regulatory Framework

Applicable legislation includes:

Environmental Protection Act 1986;

Environment Protection and Biodiversity Conservation Act 1999;

Rights in Water and Irrigation Act 1914;

Conservation and Land Management Act 1984;

Soil and Land Conservation Act 1945;

Mines Safety and Inspection Act 1994 and associated Regulations;

Mining Act 1978; and

Mining Regulations 1981.

Rehabilitation requirements may be imposed through conditions imposed on each mining lease. In addition, conditions associated with the Ministerial Statements of approval would apply once the Project achieves environmental approval. Therefore, the CWC recognises that some elements of the framework outlined in this draft Progressive Rehabilitation Plan are likely to change.

4.1 Rehabilitation Reviews

CWC commissioned a range of investigations aimed at assessing pre-disturbance baseline environmental conditions in order to assist in designing a comprehensive Progressive Rehabilitation Plan. These included:

- Blandford (2008a) Landforms and Soils, in: *Draft Public Environmental Review – Central West Coal Project.* Prepared for Aviva Corporation Ltd.
- Blandford (2008b) *Soil Management Plan – Environmental Management.* Unpublished Report prepared for Aviva Corporation Ltd.
- Kew Wetherby (2008) Unpublished Report "Desktop Study and Baseline Soil Survey of the Central West Coal Project and Coolimba Power Project South West of Eneabba, WA Prepared for URS on Behalf of Aviva Corporation Limited (January 2008)
- Mattiske (2008) *Flora and Vegetation Assessment of the Aviva Lease Area.* Prepared for URS Australia Pty Ltd on behalf of Aviva Corporation Ltd. November 2008.
- URS (2008) *Predicted Impacts of Ash Co-Disposal on Groundwater – Central West Coal and Coolimba Power Projects.* Draft Report prepared for Aviva Corporation Ltd. November 2008.
- *ecologia* Environment (2008) *Central West Coal Project and Coolimba Power Station.* Prepared for Aviva Corporation Ltd. August 2008.
- Terrenus (2008) *Geochemical Assessment of Overburden, Potential Coal Reject and Coal Combustion Ash.* Central West Coal Project and Coolimba Power Project. Draft Report Prepared June 2008.
- Bennelongia Pty Ltd (2008) *Risk Assessment for Bathynellidae at the Central West Coal Project.* Unpublished report prepared for Aviva Corporation Ltd. November 2008.
- URS Australia Pty Ltd (2009a) *Central West Coal Projects – Surface Water Assessment* Prepared for Aviva Corporation Limited 25 February 2009.
- Rockwater Pty Ltd (2009) *Central West Coal Project – Pit-dewatering Assessment and Bore Completion Report*. Unpublished report prepared for Aviva Corporation Ltd, February 2009.

The significant findings of these investigations relevant to rehabilitation include:

- The project area is located within a region that experiences hot, dry summers and mild winters (BoM, 2008a). Mean maximum monthly temperatures range from 19.6˚C (July) to 36.1˚C (February). Mean minimum monthly temperatures range from 9.0˚C (August) to 19.5˚C (February). Mean annual rainfall is 504mm over 60.5 rain days. The highest and lowest mean monthly rainfall of 104mm and 7mm occurs in June and January respectively. Annual evaporation is approximately 2400mm.
- The availability of rainfall during the summer months requires that rehabilitation will need to be carefully planned. Blandford (2008b) noted that the presence of weathering ferricrete and the associated elevated clay content indicated good water holding potential for vegetation use. Mattiske (2008) reported that the majority of plants of the project area are dependent on soil moisture from rainfall events and that the majority of the plant species are herbs or small shrubs that have shallow root systems. Consequently it will be important to ensure that similar characteristics to that in the pre-disturbance soil profile are maintained in the reconstructed soil

profiles, ensuring that surface infiltration rates are similar to that existing prior to disturbance (Blandford, 2008b).

- The physical and chemical characteristics of the reconstructed profile are also important to rehabilitation success. All overburden materials tested exhibited high exchangeable sodium percentages (ESP) indicating potential for dispersion if exposed on surfaces, or used as structural fill or as a growth medium replacement for top-soil (Terranus, 2008). Similarly, sub-soils have also exhibited dispersive characteristics (Blandford, 2008). Consequently overburden and subsoil will generally be unsuitable for use as plant growth medium or structural fill unless these characteristics can be modified, for example by lime addition.
- It will be necessary for rehabilitation earthworks to reinstate the hydraulic features of a small number palaeo drainage channels, which are believed to act as conduits for east-west flow of subsurface water. These sub-surface drainages feature a high permeability horizon underlain by lower permeability horizons.
- Special attention may be given to re-establishment of Priority Flora
- Special attention may be given to re-establishing habitat for Rare and Priority Fauna

5.1 Introduction

The primary aim is for rehabilitation to occur progressively so that landform reconstruction and revegetation occur as soon as possible behind the mining operations. The normal mining operation is expected to maintain an open area of approximately 120 ha. The re-instatement of the soil profile systems has been identified as important for rehabilitation success, to ensure the reconstructed profile provides similar functions to the pre-disturbance profiles.

The rehabilitation process outlined in this section has been designed on the basis of the findings described in the previous sections. It presents the basic components of the Progressive Rehabilitation Plan. Further components of the Plan will also include some of the additional measures outlined in the following section on Research and Development.

Mining will occur progressively and will comprise an open cut mine to extract approximately 2 to 2.5 million tonnes per annum (Mtpa) of sub-bituminous coal. The mine will progress along the orebody and with a disturbed open area of approximately 120 ha at any one time, with a continual backfill and progressive rehabilitation programme. The mine face will be advanced in increments at the rate of approximately 400 m per year. The size of each incremental advance will depend on a number of factors yet to be confirmed, but are likely to be in the range 100 to 200 m.

Prior to commencement of mining, the pit and any other areas that will be disturbed by construction activities will be topographically surveyed to guide landform development in the rehabilitation phase. The areas disturbed will accommodate the mine, access roads,,mine de-watering infrastructure, power lines, water pipelines, raw water storage dam, stockpile hardstands, surface water control infrastructure, workshop, stores and administration buildings. Vegetation and topsoil cleared from these areas will be stockpiled for future use.

During initial mine development, which will occur over the first 2 years of operation, vegetation and topsoil that cannot be placed directly in rehabilitation works, will be stockpiled separately for future use..

During the subsequent normal mining phase, which extends from year 2 for ~28 years to the end of the mine life, most cleared vegetation and topsoil will be placed directly onto any re-contoured areas requiring rehabilitation. This will usually be zones of the backfilled pit, and any other disturbed areas that are no longer required for operations and are ready for final rehabilitation.

The mine area will include a number of zones where different activities are occurring. The backfill areas will include a lower level zone accessible from within the mine, a zone where bulk backfilling is occurring above the lower level through to a sub-soil or top-soil-ready surface, a zone where sub-soil reconstruction might be occurring, and a zone ready to receive top-soil and final rehabilitation.

During mining, faces on each bench will be photographed, mapped and sampled. The purpose of work will be to:

- Obtain samples for soil and waste rock characterisation, including physical, mineralogical and geochemical properties.
- Map the extent and physical features of any recognisable features, such as palaeo drainages, which should remain connected across the pit after backfilling.

- Confirm and develop understanding of sub-surface features which are important to the success of rehabilitation.

The progressive rehabilitation sequence will typically be as follows:

- Topsoil will be stripped from the next mining increment area and will be placed directly onto the next available previously re-contoured mine backfill area.
- Any suitable subsoil materials will be placed in the adjacent partially completed backfill zone where sub-surface features are being re-instated. Typically these will be palaeo-drainage re-constructions requiring placement of low permeability and high permeability horizons. Some of these materials may also be stockpiled for future use in the stockpile management corridor.
- Topsoil will be spread over the contoured sub-soil surface.
- Vegetation clearing debris will then be spread across the surface.
- The area will be seeded with a mixture of endemic native seeds.

Detail on the proposed rehabilitation tasks is provided in the following sections.

5.2 Details of Rehabilitation Process

5.2.1 Landform Reconstruction

Landform surveying will be conducted prior to clearing. A topographic and photographic record will be used to guide landform reconstruction. Generally the final landform will reflect the shape and character of the surfaces existing prior to mining. However, on occasions, it may be impractical to reconstruct landforms closely, in which case, the functionality and general appearance of the final surfaces will be re-instated. For example, when the pit is made deeper or wider, there will be excess backfill compared to the void available and the backfilled level will be above the original ground level. Conversely, if the pit shallows or becomes narrower, there will be insufficient backfill material available to completely fill the deeper or wider pit behind the mining operation and the backfilled level will be below the original ground level.

As noted in earlier sections of this plan, successful rehabilitation will depend, in part, on re-instatement of soil profile characteristics. So rehabilitation planning will identify and provide for soil profile characteristics to be re-instated where necessary or desirable. The reconstructed soil profile will generally contain:

- A topsoil horizon.
- An upper subsoil sand horizon.
- A lower subsoil horizon comprising weathering ferricrete/gravel/sand.

A key component of both landscape and profile reconstruction will be to aim to return surface infiltration rates to that existing prior to disturbance. This will be achieved in a number of ways, including:

- Ensuring the reconstructed profile contains a minimum depth of one metre of high permeability sand as the surface medium for plant growth.
- Deep ripping the profile following reconstruction on the contour to destroy elevated compaction resulting from trafficking by reconstruction machinery.

5.2.2 Vegetation and Topsoil Removal and Replacement

Vegetation will be cleared on a periodic basis immediately ahead of the mine face and placed immediately behind the mine operations onto areas previously prepared for rehabilitation. Where this is not possible, cleared vegetation will be used to cover soil stockpiles or stockpiled separately. Topsoil (approximately the top 120 mm) is a key resource as it contains the majority of the viable seed store and also a large amount of vegetation. The appropriate management and maintenance of topsoil will increase the potential success of the rehabilitation programme, as it will prevent or reduce the amount of biological deterioration in the soil.

Prior to stripping, the physical and chemical characteristics of the topsoil will be defined and assessed for specific management requirements and the most appropriate topsoil stripping technique will be determined. The characteristics to be defined will include:

- Basic chemical characteristics including Electrical Conductivity (EC), Total Dissolved Solids (TDS), pH, and aggregate stability.
- Particle Size Distribution (PSD) and permeability.
- Mineralogy.

Direct return of vegetation from cleared areas to the rehabilitation sites behind the mine will decrease the potential for wind erosion. In addition, the direct return of vegetation will augment natural topsoil seed stores, and provide protection and nutrients to seedlings and fauna.

Direct placement of vegetation and topsoil within the rehabilitation area will occur periodically during the year. Where possible, topsoil handling will be undertaken when wind speeds are low, and prior to the onset of winter. Rainfall will promote seed germination and growth of early colonisers that will assist in stabilising the soil surface.

When direct placement of vegetation and topsoil is not possible, vegetation and topsoil will be stored in separate stockpiles. Stockpiles will be located where they will not be disturbed until needed for final placement. The stockpiles will be surveyed and entered in a register which will record details of the contents. Vegetation and topsoil will not be stripped when wet, as this will lead to increased compaction and loss of structure.

5.2.3 Subsoil Removal and Replacement

Subsoil is defined as that soil material that lies directly below the topsoil and forms part of the solum. The subsoil horizon varies across the site and comprises:

- Sand in a range of forms (sand).
- Sand with small amounts (<10%) of clay (clayey sand).
- Material dominated by weathering ferricrete and with varying amounts of clay and minor gravel.
- Discrete gravel zones.
- Weathering ferricrete with abundant gravel and clay.

There may be opportunity to selectively recover some subsoil components which could be used in specific locations to re-instate similar sub-surface characteristics in the reconstructed soil horizons. This will depend on the distribution of these components and whether it is practical to recover them in a useful form. Where possible, the horizons will be stripped separately on a periodic basis immediately after the removal of the vegetation and topsoil, and placed immediately behind the mine operations. Where possible, subsoil will not be stripped when wet, as this will lead to increased compaction and loss of structure.

Where subsoil can be recovered and stockpiled or directly placed, the following characterisation tests will be implemented prior to removal:

Upper subsoil sand horizon:

- Permeability.
- Aggregate stability class.
- Particle size distribution.

Lower subsoil horizon (comprising weathering ferricrete/gravel/sand):

- Permeability.
- Aggregate stability class.
- Particle size distribution.
- Exchangeable sodium percentage (ESP).
- Dispersion percentage.

Where the following characteristics are all present in the same soil, the material would normally be regarded as unsuitable for use in surface profile reconstruction, buried deeper within the profile and defined as material not suited for near-surface profile reconstruction:

- Clay content >30%.
- Dispersion percentage >30.
- ESP >16.
- Aggregate stability class of 1 or 2.

However, where only one or two of the above parameters are identified, the soil material may be treated by the addition of calcium sulphate to replace to improve the imbalance of calcium ions relative to sodium and magnesium ions in the clays. The volumes of calcium sulphate to be added to the soil will be confirmed by laboratory analysis. Where a soil material is to be ameliorated with calcium sulphate, mixing will be carried out at the time of placement.

Where subsoil is to be stockpiled, the subsoil horizons (upper and lower) will be placed in separate stockpiles and either seeded or covered with vegetation, to minimise wind erosion and dust formation, and maintain beneficial micro-organisms, prior to replacement. Stockpiles will be placed in areas where they will not be disturbed by future activities and all stockpile locations will be signposted.

It is inevitable that mixing of different subsoil materials will occur, and for this reason, subsoil stockpile will be tested prior to use. The testing regime to be implemented will ensure that any problem materials are identified and that the correct amelioration strategies implemented.

5.2.4 Waste Rock Removal and Disposal

The placement of waste rock is described in detail in Section 8 of the PER. In summary, the placement of waste rock primarily recognises its potential for acid generation, and secondly its suitability as a rehabilitation growth medium or structural fill.

More than 80% of waste rock materials tested are classified non-acid forming, and may be used anywhere in the backfill profile where plant growth and structural stability is not an issue.

Generally waste rock will be unsuitable for use as a growth medium without treatment because all components tested have exhibited significant cation imbalances.

In addition, all waste rock materials tested are strongly sodic, indicating unsuitability as structural fill, and prone to dispersion and erosion if exposed.

Consequently most waste rock components will not be used as a sub-soil replacement. CWC will extend characterisation testing to confirm the suitability of waste rock for potential use as structural fill or growth medium.

5.2.5 Disposal of Coal Combustion Ash

Coal combustion ash will be generated as a product of the power plant and may be used as backfill in the open pit during progressive rehabilitation. URS (2008) assessed the potential impact of using of coal combustion ash as backfill on groundwater within the pit. Geochemical tests were conducted by Terrenus (2008) to identify the chemical characteristics of the coal combustion ash, and leaching tests were compared with water quality guideline values to assess the potential risk of contamination. It was found that, despite the relatively low total metal concentrations in coal combustion ash samples, leachate from the coal combustion ash is likely to contain some dissolved metals in concentrations that may exceed the applied ANZECC (2000b) 90% and 95% trigger values for freshwater aquatic ecosystem protection and also ANZECC (2000a) livestock drinking water guideline values. The key metals of concern are Al, As, B, Cr, Cu, Mo and Zn. Solute transport modelling by URS has shown that substantial solute dilution would occur upon entry of leachate to groundwater and that metal concentrations would likely remain close to background concentrations in groundwater.

Because there appears to be no advantage placing ash in a subsoil or topsoil profile, and on account of it having potential to contribute metals to groundwater, albeit in concentrations that would likely be immaterial, CWC has resolved not use ash for direct rehabilitation purposes,

By placing ash at the lower levels in the mine backfill, and avoiding placement in surface impoundments, potential rehabilitation issues are avoided.

5.2.6 Reconstruction of Surface and Palaeo Drainage Channels

Surface drainage lines temporarily diverted by mining operations will be re-instated to the same form and function they possessed prior to diversion. This may require consideration of the nature of the underlying soil characteristics, particularly in respect of the permeability of sub-invert horizons, so that surface water infiltration characteristics of the drainage bed are maintained.

Field evidence indicates that palaeo drainage channels are acting as conduits for the east-west flow of subsurface water (Blandford, 2008b). The location and nature of the palaeochannels will be confirmed prior to landscape and profile reconstruction with specific attention given to the depth and nature of the gravels. Once this has been determined, channel reinstatement will include replacement of a high permeability horizon, at the appropriate depth, to simulate pre-disturbance conditions.

5.2.7 Revegetation

Although a seed bank is present in the topsoil, further seeding will improve the success and rate of revegetation. Seed will be collected from as wide a range of local species as possible, though as mining operations are likely to result in the removal of plants listed as Priority Flora species, particular attention will be paid to seed collection from these taxa in order to retain their populations within the local area. CWC will determine the flowering periods of the vascular plants found within the project area and will use this information to plan seed collection activities.

Seeding will occur seasonally. The majority of the seeding will occur in April/May, just prior to winter rains. Rehabilitation areas will initially be seeded with species known to be successful early colonisers. If appropriate, seeds of species that prefer more established ecosystems (late successional species) will be introduced into the rehabilitation areas once an initial vegetation cover has been established. Seeding will be done by hand after all earthworks are complete, or with a commercially available seeder attached to a multi-tyned bulldozer.

Seeds will be returned into areas where the particular species are known to survive. For example, species from plant community H3 will be sown in areas that were previously dominated by the H3 plant community. Seeds of recalcitrant species (species with high levels of seed dormancy or specific germination requirements) will be treated to increase germination potential. Those seeds of late successional species will be treated to prevent insect and fungal attack before being placed in suitable dry storage areas, protected from vermin and insect predation. These seeds will then be spread once an initial colonising community has established.

An investigation into the most appropriate species for use in revegetation will be conducted, with three factors taken into consideration:

- All species should be native to the area. To help maintain the local character of rehabilitated areas only species found in previous local flora surveys should be included.
- The species mix should include as many annual species as possible, as these will usually germinate within the first winter and quickly provide protection for further species and fauna.
- Plants should be adapted to the new habitat that is likely to prevail over the long term.

5.3 Further Measures

Further procedures that will be implemented to improve rehabilitation include:

All water points generated through the construction of the mine or the mining process will be fenced in order to deny access to mammalian fauna. This increase in population may affect the rehabilitation process through increased grazing pressure, and also act as a prey trap, as the increase in species populations may indirectly increase populations of introduced predators. Therefore, CWC will deter all animals from any water points created. Matting will be placed on the edges of the water points in order to allow exit points for small mammals and reptiles that may have gained entry through the fencing, as well as exit points for birds.

To prevent damage to germinating vegetation, vehicle access to all recently rehabilitated areas will be prohibited unless absolutely essential.

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Field studies conducted to date have indicated that further investigations will be required to provide a comprehensive, effective and successful rehabilitation programme. Aspects include:

The most appropriate topsoil stripping technique.

The following physical and chemical characteristics of the topsoil will be defined and the most appropriate topsoil stripping technique investigated and identified:

- Basic chemical characteristics including EC, TDS, pH, and aggregate stability.
- Particle size distribution and permeability.

The volumes of calcium sulphate to be added to subsoil will be confirmed by laboratory analysis. Where only one or two of the below parameters are identified, the soil material may be treated, in terms of ESP and aggregate stability by the addition of calcium sulphate to replace Na ions with Ca ions on the exchange complex of the clays:

- Clay content >30%.
- Dispersion percentage >30.
- ESP >16.
- Aggregate stability class of 1 or 2.

Maximising the materials available for profile reconstruction and rehabilitation.

The presence of both spontaneous dispersion and post compaction deflocculation in materials used for rehabilitation, and post compaction deflocculation in surface soils, requires further materials investigations as part of environmental management. This investigation will involve a materials characterisation programme to ensure that maximum benefit is gained from the materials available for profile reconstruction and rehabilitation.

The rehabilitation of the existing Iluka tailings ponds.

The northern portion of the deposit is on an area that has already been mined (and mostly rehabilitated) by previous mineral sands miners. These mining activities have been in the top 20 to 30 m of strata only. The rehabilitation of this area has included the placement and rehabilitation of a series of tailings ponds. It is expected that these ponds will still be significantly moist at the time of mining for the Project. The method of managing these tailings materials is not yet defined, however, it is expected that the tailings material will be included in the backfilling operation of the advancing mine. The tailings material will potentially be placed at a depth below their current surface level and covered with subsoil and topsoil prior to final rehabilitation. In-pit confinement ponds will potentially be built to contain the tailings material within the backfilled areas.

The rehabilitated Iluka mine area.

CWC will endeavour to liaise with, and obtain from, Iluka, details of rehabilitation practices (including trials conducted and results obtained) conducted at the current Iluka mineral sands mine. The details of Iluka's rehabilitation practices could be significant in regards to increasing the success and effectiveness of the Projects rehabilitation practices.

The most appropriate species for use in revegetation, including an outline of the flowering periods of the vascular plants found within the project area.

Additionally, rehabilitation trials will be conducted during the early years of mining, and corrective measures may need to be considered should rehabilitation performance not achieve nominated completion criteria, or be trending away from the nominated criteria. Rehabilitation trials, and corrective actions identified through the rehabilitation monitoring and reporting programme, may potentially include:

- Weed control

Twenty introduced species were identified during the flora and vegetation surveys (Mattiske, 2009). Management of weeds may be necessary if weed population are found to be in high densities or adversely impacting rehabilitation.

- Hygiene management

Should rehabilitation practices cause the spread of the *Phytophthora cinnamomi* pathogen, additional hygiene management measures will need to be implemented.

- Cover Crops

Ground cover will aid and protect germinating seeds, seedlings and fauna. If local species cannot provide rapid adequate cover it may be necessary to sow a cover crop. This would be an infertile annual species not capable of reproducing.

Fertiliser

Although the topsoil of the project area is generally chemically and physically infertile, the use of fertiliser may assist the germination and initial growth of vegetation.

- Seed treatment

Some seeds require a treatment (scarification, soaking, etc) prior to planting. This can drastically increase the germination rate. Seed treatments will be investigated if necessary to maximise revegetation success.

- Planting of seedlings

Directly planting of seedlings will be conducted during the rehabilitation process to increase site density and floristics.

- Fencing

Grazing pressure may decrease the success of rehabilitation and fencing (specifically herbivore proof fencing) would protect seedlings and increase rehabilitation effectiveness.

- Seeding proportions

Seeds from species that regenerate successfully directly from re-spread topsoil and vegetation material should be dropped from the list, with efforts directed at re-establishing ‘recalcitrant’ species.

- Over represented species control

Management of native species that are over represented compared to the pre-disturbance populations may need to be conducted.

- Mulching vegetation

Although direct respreading of vegetation is generally considered the most effective method of re-using cleared vegetation for rehabilitation, mulching of vegetation prior to respreading may improve rehabilitation success and should be considered if appropriate.

- Success of Priority Flora species

Monitoring of Priority flora species in rehabilitated areas will indicate whether establishment goals are attainable.

- Success of re-instatement of palaeo and surface water drainages

Monitoring of pre and post mining groundwater and surface flow characteristics along rehabilitated drainages will potentially be important to provide confirmation of the design and implementation of the rehabilitation effort.

- Erosion

Monitoring of erosion will likely provide insight into the success of treatment of dispersive soils, and post compaction deflocculation characteristics.

- Iluka rehabilitation outcomes

It will be useful to compare methods and outcomes, to take advantage of prior learning.

Should the rehabilitation monitoring programme (Section 8) indicate landscape dysfunction or loss of health over time, one or more of the above contingency actions may be required. However, where rehabilitation criteria (Section 7) are not reached but rehabilitation monitoring indicates increased ecosystem health, intrusive remedial action may be inappropriate, with the rehabilitation only requiring more time.

The below draft rehabilitation criteria need to be finalised to the satisfaction of the relevant stakeholders, and then regularly reviewed over the course of the life of the Project. Should research and development programmes implemented by CWC significantly increase rehabilitation techniques, the rehabilitation criteria may be reviewed in liaison with stakeholders. As discussed previously, should rehabilitation monitoring indicate that ecosystem health is improving, but rehabilitation criteria are not met, some flexibility should in terms of timelines should be granted.

The rehabilitation criteria in Tables 7-1 to 7-5 are designed to set well defined and achievable targets for the return of disturbed areas to prior land use. Criteria have been established for years 0, 1, 2, 5, 15 and 30.

Table 7-1 Rehabilitation Criteria for Year 0

ASPECT	CRITERIA
Landform – L0(1)	The landform will have been reconstructed to a form that visually merges with the surrounding land contours.
Landform – L0(2)	Palaeochannel and surface drainage reinstatement will have included replacement of a high permeability horizon to simulate pre-disturbance conditions.
Soils – S0(3)	The reconstructed soil profile contains three major elements: upper topsoil, lower subsoil horizon and upper subsoil sand horizon.
Soils – S0(4)	The reconstructed soil profile will contain a minimum depth of 1.0 m of high permeability sand as the surface medium for plant growth.
Vegetation–V0(5)	Vegetation has been spread over rehabilitation area.
Access – A0(6)	Access roads have been retained around the rehabilitation area, as required for ongoing weed management and landscape monitoring.
Safety – Saf0(7)	No hazards remain from the mining process that may jeopardise health and safety, or negatively affect the rehabilitation process.

Table 7-2 Rehabilitation Criteria for Year 1

ASPECT	CRITERIA
Soils – S1(1)	The rehabilitation area shows no signs of major surface instability.
Soils – S1(2)	Surface infiltration rates are similar to that existing prior to disturbance.
Vegetation – V1(3)	Native seedlings present and providing >1% of projected foliage cover.
Access – A1(4)	Access roads have been retained around the rehabilitation area, as required for ongoing fire and weed management, and landscape monitoring.

Table 7-3 Rehabilitation Criteria for Year 5

ASPECT	CRITERIA
Soils – S5(1)	Surface infiltration rates are similar to that existing prior to disturbance.
Vegetation – V5(2)	Projected foliage cover values >20% of analogue sites.
Vegetation – V5(3)	Average species diversity >20% of analogue sites.
Vegetation – V5(4)	Native vegetation providing >20% of projected foliage cover.
Access – A5(5)	Access roads have been retained around the rehabilitation area, as required for ongoing rehabilitation monitoring and management.

Table 7-4 Rehabilitation Criteria for Year 15

ASPECT	CRITERIA
Soils – S15(1)	Surface infiltration rates are similar to that existing prior to disturbance.
Vegetation – V15(2)	Projected foliage cover values >50% of analogue sites.
Vegetation – V15(3)	Average species diversity >50% of analogue sites.
Vegetation – V15(4)	Native vegetation providing >50% of projected foliage cover.
Access – A(5)	Access roads have been retained around the rehabilitation area, as required for ongoing rehabilitation monitoring and management.

Table 7-5 Rehabilitation Criteria for Year 30

ASPECT	CRITERIA
Vegetation – V30(1)	Projected foliage cover values comparable to those of analogue sites.
Vegetation – V30(2)	Average species diversity >80% of analogue sites.
Vegetation – V30(3)	Native vegetation providing >80% of projected foliage cover.
Vegetation – V30(4)	Projected foliage cover of weed species is comparable to analogue sites.
Access – A30(5)	Access roads have been retained around the rehabilitation area, as required for ongoing rehabilitation monitoring and management.
Infrastructure – I30(6)	All infrastructure not left for other users has been removed, apart from access roads required for ongoing rehabilitation monitoring and management.
End Land Use – E30(7)	The sites meet the agreed post mining land use/s.
End Land Use – E30(8)	Rehabilitation is progressing towards characteristics of analogue sites.

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8.1 Monitoring Programme

Information obtained from the following monitoring programmes and site assessments will assist in the establishment of performance indicators:

Landform health

Tongway and Hindley's (2004) landscape function analysis is a monitoring programme designed to monitor the health and functionality of a system at the landscape scale.

Soil monitoring

A soil monitoring programme will be implemented to compare the surface infiltration rates, particle size distribution, density, and soil moisture in undisturbed analogue sites and the reconstructed profile, as well as for assessing for the presence of both spontaneous dispersion and post compaction deflocculation.

Permanent vegetation monitoring plots in rehabilitated areas

Monitoring of these plots will be conducted to determine the success of the rehabilitated vegetation, and especially Priority flora. Information collected will be analysed and will aid in determining improvements in rehabilitation techniques. Regular photographic monitoring will also be conducted within these permanent monitoring plots.

Additional permanent vegetation plots

Establishment of these plots will be conducted in order to monitor any changes in vegetation health and structure in adjacent undisturbed areas. This vegetation monitoring will assist in determining impacts to vegetation from aspects such dust and hydrocarbon spills, and increased weed presence.

Permanent fauna monitoring plots

These plots will be established in rehabilitated areas in order to monitor the return of fauna to rehabilitated areas and hence rehabilitation success. Information collected will be analysed and will aid in determining improvements in rehabilitation techniques.

Additional permanent fauna monitoring plots

Establishment of these plots will be conducted in order to monitor any changes to fauna diversity and abundance potentially bought about due to Project activities.

The results of these monitoring programmes would then be audit results against performance criteria to determine if intervention and alterations to rehabilitation techniques is required. Central Coal West Pty Ltd will prepare a schedule that illustrates how often these programmes will be conducted, which will include:

- Responsibility - who was responsible for completing the criteria.
- Status – e.g. 'not yet applicable', 'complete', in progress', 'non-compliant'.
- Timing – start and finish dates for tasks.
- Corrective actions – details of any management required to address non-compliance.

This schedule will be a checklist for implementation by rehabilitation staff and for auditing of rehabilitation performance by regulators.

8.2 Reporting

An annual review of the results of these monitoring programmes will be undertaken to determine the success of the rehabilitation performance in meeting the completion criteria. These results would then be reported to the DEC and the Department of Mines and Petroleum (DMP) in the Annual Environmental Report (AER). This report will also include results from research and development programmes.

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