

## 10.19 Post-Mining Closure and Rehabilitation

GSS Environmental (GSSE) was engaged by Centennial Mandalong to prepare a *Decommissioning and Rehabilitation Strategy* for the Mandalong Southern Extension Project to address the methodologies and management strategies for post-mining closure and rehabilitation. The overall purpose of the Strategy was to derive the most appropriate options for closure in terms of performance and cost. Key aspects include:

- Establishing an overall vision for closure, with general objectives for the rehabilitation and ultimate closure of the site;
- Identifying closure options and evaluating these options against the vision to assess their viability;
- Defining objectives and targets to achieve the preferred closure options; and
- Describing the communication and consultation process for the preferred options.

A copy of the *Decommissioning and Rehabilitation Strategy* (GSSE 2013c), which has been prepared in accordance with the DGRs (see **Section 1.7.2**), is contained within **Appendix E**, with significant findings and recommendations summarised below.

### 10.19.1 Rehabilitation Objectives

Planning for mine closure involves integrating the closure objectives for the Project, identifying the timing for the closure process, considering issues that relate to specific rehabilitation methods and objectives, and considering community expectations. The principal objectives of the *Decommissioning and Rehabilitation Strategy* (GSSE 2013c) for the Project are to:

- Provide an overall framework for mine closure including rehabilitation and decommissioning strategies;
- Reduce or eliminate adverse environmental effects once the mine ceases operation;
- Ensure closure is completed in accordance with leading industry practice;
- Ensure that the land can be used for a suitable beneficial use post closure;
- Ensure that the impacts are minimised and that the needs of employees and the local community are considered in the closure planning process;
- Ensure, where practicable, that consideration is given to the biodiversity value of the surrounding area and integrate these values with the final land use options;
- Establish clear and agreed criteria that can be used to provide the standard against which the final mine rehabilitation and post mining land uses can be assessed; and
- Ensure the closed mine does not pose an unacceptable risk to public health and safety.

GSSE (2013c) defines the principle *rehabilitation* objectives for the Project to be:

#### **Achieve an acceptable post-disturbance land use**

Rehabilitation of disturbed areas will aim to create a land use capability and/or suitability compatible with the pre-mining land use, unless other beneficial land uses are pre-determined and agreed.

#### **Create a stable post-disturbance area**

Disturbed land will be rehabilitated to a condition that is self-sustaining or a condition where maintenance requirements are consistent with an agreed post-mining land use. Any surface water features, for example dams, retained on the lease will be safe, self-sustaining and acceptable for the post-mining land use.

### **Preserve downstream water quality**

The quality of surface water and groundwater that leave the mining lease areas will be adequate to maintain environmental values and beneficial uses downstream of the Project Application Area.

### **10.19.2 Closure Domains and Preliminary Land Use Options**

In order to effectively address the various land uses, GSSE (2013c) divided the Project Application Area into three management “domains” and nominated post-mining land use options in consideration of pre-mining conditions, current surrounding land use and local planning strategies. The management domains and proposed post mining land uses are summarised below and shown on **Figure 64**.

These domains will be reviewed and developed in to specific sub-domains that address the requirements of the rehabilitation hierarchy as part of the MOP that will be required to be prepared (in accordance with the DRE guidelines) and approved to permit coal extraction within the Southern Extension Area.

#### **Domain 1: Infrastructure Areas**

Domain 1 comprises the Mandalong Mine Access Site, which is intended to be re-developed for an industrial-based land use(s), and the Mandalong South Surface Site, which is intended to be decommissioned and rehabilitated to native bushland commensurate with the surrounding environment.

#### **Domain 2: Underground Services Infrastructure**

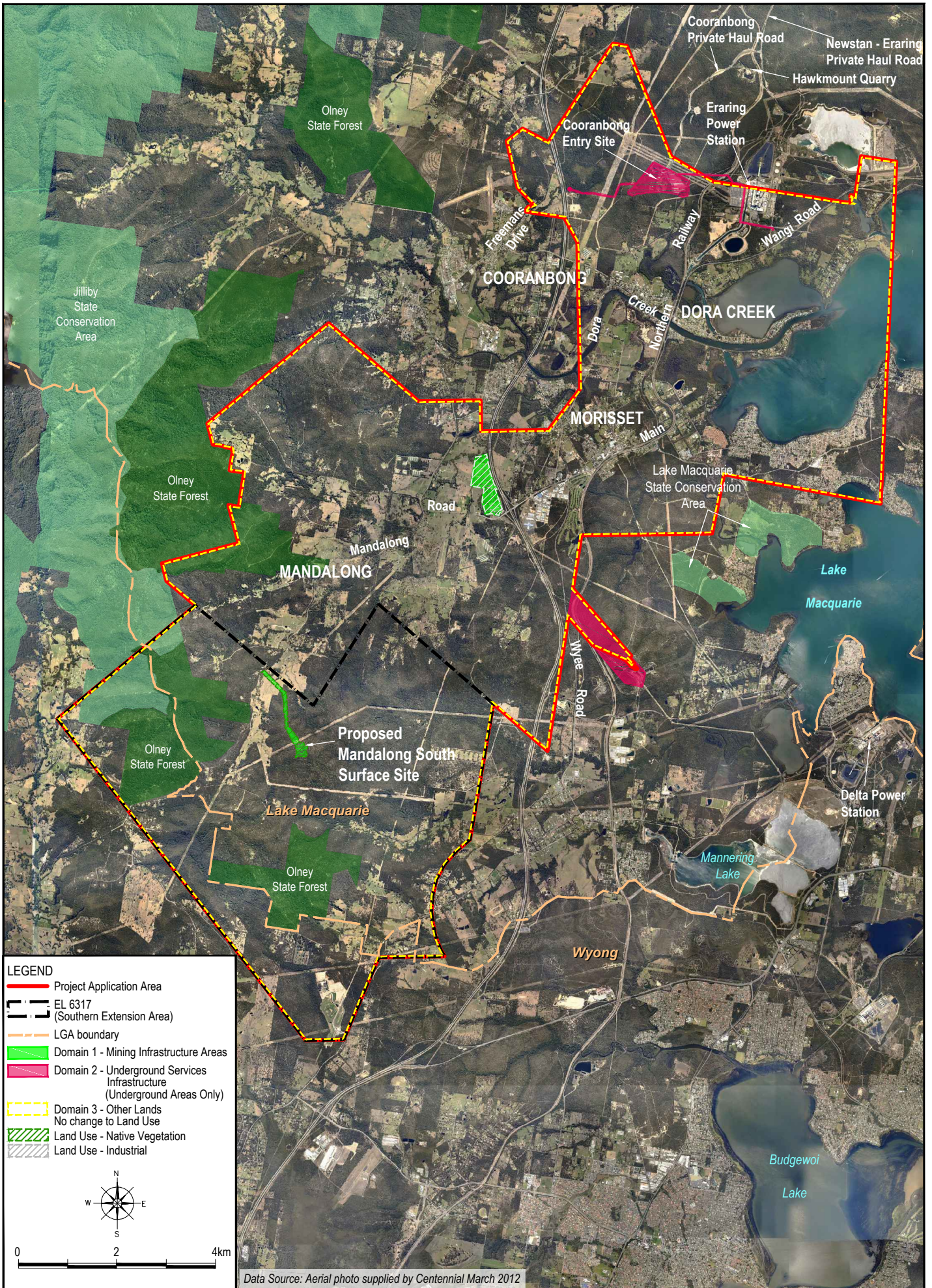
Domain 2 comprises the underground coal delivery system infrastructure at the Delta Entry Site and Cooranbong Entry Site, along with the mine ventilation shaft, ventilation fan and Borehole Dam at the Cooranbong Entry Site. As previously outlined, the surface infrastructure within Domain 2 does not form part of the Mandalong Southern Extension Project (with the exception of the mine ventilation shaft and fan and Borehole Dam at the Cooranbong entry Site) and there is no surface disturbance proposed at these two sites as part of the Project. On this basis, post-mining land use has not been addressed by GSSE (2013c) for this domain. However, decommissioning of infrastructure and services will be undertaken in accordance with relevant guidelines and standards and, where necessary, approvals.

Rehabilitation and post-mining land use for the Cooranbong Entry Site will be addressed as part of Centennial’s Northern Coal Logistics Project.

#### **Domain 3: Other Lands**

Domain 3 comprises all areas within the Project Application Area not captured in Domains 1 and 2. It is anticipated that there will be very little rehabilitation works required in this domain given it is an underground mining operation and DGS (2013) concludes that the assessed range of potential subsidence impacts will be manageable for the majority of natural and man-made features (see **Sections 9.5 and 9.6**). During the life of the project there may be a need to rehabilitate exploration drill pads and access tracks, which will be undertaken in accordance with Centennial’s exploration protocol, and areas potentially impacted by subsidence (for example, surface cracking and erosion), which will be managed on an on-going or as needs basis under the approved SMP and/or Extraction Plan.

As there will be very limited disturbance within Domain 3 and the pre-mining land use will not be significantly impacted, the post-mining land use will be generally consistent with pre-mining conditions and will primarily comprise a mix of grazing and native forest, with small areas of residential and special uses land.



\\news1s\GSSSE Resources\Drafting\Mandalong\CCC14-009\Figures\Final\CAD\FINAL FIGS EB Report\MANDALONG EIS FIGURES\CAD (2nd External Review)\Fg64\_CCC14-009\_ClosDomains&PreLU\_V4.dwg  
To be printed A4

### 10.19.3 Decommissioning

A decommissioning and demolition strategy will form an integral part of the detailed closure planning, which will be undertaken as the Project approaches five years from the planned mine closure. It will involve engaging structural engineers and appropriate technical experts with experience in demolition and the application of relevant Australian Standards and guidelines. A detailed investigation of all structures will be completed at that stage to determine the appropriate techniques, equipment required, and the sequence for decommissioning and removal required to execute the demolition activities safely.

Prior to commencement of demolition, an asset register will be distributed to all other Centennial sites to ascertain whether any of the key assets can be re-used within the Centennial business. Other key steps identified by GSSE (2013c) for decommissioning include:

#### Site Investigation

A site investigation will be conducted to confirm the following:

- The type, location and extent of underground services such as conduits, cables and pipe work owned and/or managed by Centennial Mandalong;
- The location and extent of underground structures to be retained and those to be removed;
- The location, type and extent of overhead services and structures such as power cables, conveyors, light poles and pipe work that are owned and/or managed by Centennial Mandalong;
- The location and condition of all tanks and vessels (with emphasis on remaining combustible materials and methods required for their removal);
- The presence of contaminated and hazardous materials and the classification and disposal of these materials;
- The general condition of adjacent structures; and
- Any infrastructure to remain following decommissioning (where appropriate).

#### Site Preparation

Prior to the commencement of any demolition activities the following tasks will be undertaken:

- All sumps will be dewatered;
- All items will be decommissioned, de-oiled, depressurised and isolated; and
- All hazardous materials will be removed and transported to appropriately licensed disposal facilities.

#### Site Infrastructure and Services

All buildings, including the main administration buildings, workshop areas, coal delivery systems (including conveyors and gantries), decline tunnels and other surface infrastructure will be demolished unless there is a future landholder who is prepared to accept the on-going liability of a structure that they may wish to use. Opportunities for the sale and/or re-use of assets and recycling of scrap steel will be maximised where possible.

Concrete footings and pads will be broken up and removed. Options for the re-use of this material (for example, crushed and used for road and track stabilisation) will be investigated as the operation approaches closure. If re-use or recycling opportunities aren't available or viable, all "non-contaminated" waste material will be disposed of in a suitable location on-site (for example, in a shaft or portal) or taken off-site to an approved waste management facility.

## Contamination

As advised in **Section 6.4.5**, Centennial commissions contaminated land assessment investigations to determine its “Duty to Report” under section 60 of the *Contaminated Land Management Act 1997*. Following Contamination Notifications to the EPA under section 60 in February 2012, Centennial Mandalong has commenced undertaking Phase 2 assessments at both the Mandalong Mine Access Site and Cooranbong Entry Site. Following the completion of these assessments, remediation plans will be developed and implemented in consultation with the EPA and an accredited contaminated land auditor to address any contamination issues identified.

Well in advance of final mine closure a preliminary investigation into potential sources of contamination, including Phase 1 sampling and analysis, will be undertaken for the Project Application Area. This will be used to determine whether a detailed assessment (for example, Phase 2 sampling and analysis) should be conducted to quantify the amount of contaminated material that may require remediation.

Where possible all identified sources of contamination will be remediated during the operational phase of the mine. In some cases, however, this may not be possible (for example, under existing slabs, and workshops) and in these circumstances the remediation will be undertaken following closure and during decommissioning.

## Hazardous Materials

Prior to the demolition of any structures, a hazardous material assessment will be undertaken to determine whether there are any hazardous materials present, including asbestos. Where hazardous materials are identified, they will be assessed and quantified to enable appropriate safety measures to be implemented during removal by a licensed contractor. All hazardous material removed from the buildings will be recorded and disposed of at an approved waste management facility.

### 10.19.4 Rehabilitation

Due to the underground nature of much of the operations proposed as part of the Mandalong Southern Extension Project, surface disturbance and the need for progressive rehabilitation, particularly revegetation, is relatively minor compared to open cut mining operations. However, Centennial Mandalong will adopt a progressive approach to rehabilitation. Rehabilitation will generally occur in these three phases, with some elements overlapping and/or occurring progressively throughout the Project:

- Construction;
- Operation; and
- Decommissioning and Mine Closure.

Key steps identified by GSSE (2013c) for rehabilitation include:

#### Topsoil Management

As recommended by GSSE (2013a) (see **Section 10.2.4** and **Appendix N**), topsoil will be stripped prior to significant surface disturbance, specifically prior to the construction of the Mandalong South Surface Site and access road, and conserved for later use in rehabilitation. The topsoils are generally suitable to facilitate germination and appropriate management of this soil through amelioration (such as treatment with gypsum or lime) will provide an acceptable and stable media for revegetation (GSSE 2013a).

#### Erosion and Sediment Control

Mandalong Mine’s currently approved and implemented EMS, including the *Erosion and Sediment Control Plan*, will be reviewed and updated for the Mandalong Southern Extension Project. The review will take into consideration the commitments made in this EIS and all relevant consent conditions.

Where surface disturbance is proposed, mitigation measures will be implemented prior to the commencement of construction activities in order to minimise erosion and prevent sediment-laden runoff.

### **Soil Re-Spreading and Seedbed Preparation**

Soil will be re-spread directly onto stripped areas where practical. As recommended by GSSE (2013a), topsoil will be spread, treated with fertiliser and seeded in one consecutive operation, where possible, to reduce the potential for topsoil loss to wind and water erosion. Soil will be re-spread to the approximate depth from which it was stripped.

Thorough seedbed preparation will be undertaken to ensure optimum establishment and growth of vegetation. All topsoiled areas will be lightly contour ripped (after topsoil spreading) and, where possible, will be ripped when the soil is moist and immediately prior to sowing. If required, the re-spread topsoil surface will be scarified prior to, or during seeding, to reduce run-off and increase infiltration.

### **Revegetation**

Species selection for areas to be rehabilitated to native bushland will focus on those species that will successfully establish on the available growth medium, bind the soil and result in a variety of structure and food/habitat resources. Whilst every attempt will be made to use species that existed prior to the commencement of mining, some additional species may be required to ensure suitable initial groundcover for site stabilisation. This may include the use of short-lived annual exotic non-invasive grass species.

A combination of native and introduced pasture species may be used on the disturbance areas to ensure the quick establishment of a continuous groundcover, thereby reducing the risk of erosion. Legumes may also be selected to assist in the supply of bio-available nitrogen to the soil.

### **Weed Management**

The presence of weed species can adversely impact on revegetation and regeneration outcomes, as well as the biodiversity value of the rehabilitated areas. Weed management will be a critical component of the rehabilitation activities.

### **Rehabilitation Monitoring and Maintenance**

A commitment to effective rehabilitation involves an on-going monitoring and maintenance program throughout and beyond the operation of the mine. A dedicated monitoring system will be established in order to assess the effectiveness of the rehabilitation works and to promptly identify the need for any corrective action.

## **10.19.5 Conceptual Rehabilitation Success Criteria**

Conceptual rehabilitation success criteria have been developed by GSSE (2013c) to provide long-term performance goals for rehabilitation activities. The Project is within the planning phase and, therefore, the rehabilitation success criteria are considered conceptual. The criteria will be further developed during the detailed closure planning, which will be undertaken as the Project approaches five years from the planned mine closure, in consultation with relevant stakeholders. This will include the development of specific, measurable, achievable, realistic, and outcome-based criteria.

The conceptual rehabilitation success criteria for the Project are provided in **Table 70**. These criteria comprise indicators for vegetation, fauna, soil, stability, land use and safety on a landform-type basis that reflect the nominated post-mine land uses of industrial and native bushland. Each criterion has been designed by GSSE (2013c) as a performance objective or standard against which rehabilitation success can be demonstrated. Meeting the success criteria (as indicated by monitoring results) demonstrates that the rehabilitated landscape is in a sustainable condition ready to be relinquished and handed back to the appropriate stakeholders (GSSE 2013c).

**Table 70 – Conceptual Rehabilitation Success Criteria**

Rehabilitation Element	Domain	Indicator	Criteria
<b>Phase 1 – Decommissioning</b>			
Infrastructure	Domain 1A	Land use (Industrial)	All buildings, water storage, roads and other infrastructure (except those used by the public) have been removed unless agreed with stakeholders for their retention.
	Domain 1B	Land Use (Native Bushland)	All infrastructure within areas to be returned to native bushland has been removed, and disposed appropriately, for example to an appropriate waste management facilities.
	Domain 2	Underground Infrastructure	All underground infrastructure will be removed where required. The length of services to be dismantled will be determined by the regulatory requirements at the time of decommissioning.
	Domain 3	Boreholes	All boreholes (except those retained for monitoring purposes) have been shut down, bore casings near the surface are removed and holes plugged or capped the regulatory standards.
	All Domains	No contamination	All sites have been assessed by a suitably qualified expert as not containing contaminants above the relevant criteria for the proposed final land use.
Safety	Domain 1A and 1B	Physical	Excavations to be rendered safe. All holes/pits and other openings are to be securely capped, filled or otherwise made safe. Access to members of the public and livestock is restricted as appropriate to site conditions. No rubbish should remain at the surface, or at risk of being exposed through erosion.
<b>Phase 2 – Landform Establishment</b>			
Landform Stability	Domain 1A and 1B	Surface water drainage	The landform is stable and contour banks and diversion drains are installed to direct water into stable areas or sediment control basins.
	Domain 1A and 1B	Erosion control	Erosion control structures are installed at intervals commensurate with the slope of the landform.
Water Storage <sup>1</sup>	Domain 1A and 1B	Stable landform	Water storages to be rehabilitated to a stable non-polluting condition.
<b>Phase 3 – Growth Media Development</b>			
Top soil <sup>1</sup>	Domain 1B	Physical and chemical parameters	Where practical, previously stockpiled topsoil will be used to sustain the proposed post-mining land use. Where it is assessed as not being suitable and alternative top-soil substitute will be considered (for example bio-solids, organics, etc.)
<b>Phase 4 – Ecosystem Establishment</b>			
Vegetation <sup>1</sup>	Domain 1B	Species composition	Where relevant, for example areas where the post-mining land use is native bush, vegetation present is commensurate with the pre-mining environment and/or nearby undisturbed reference sites.
<b>Phase 5 – Ecosystem Development</b>			
Vegetation <sup>1</sup>	Domain 1B	Community structure	That the community structure is commensurate with pre-mining conditions and/or nearby undisturbed reference sites.
	Domain 1B	Sustainability	Species are capable of setting viable seed, flowering or otherwise reproducing. Evidence of second generation of tree/shrub species.

Rehabilitation Element	Domain	Indicator	Criteria
Fauna <sup>1</sup>	Domain 1B	Vertebrate Species	The number of vertebrate species does not decrease by more than 25% in the successive seasons prior to mine lease relinquishment or by more than 40% over the two successive seasons prior to mine lease relinquishment.
	Domain 1B	Invertebrate species	Presence of representatives of a broad range of functional indicator groups involved in different ecological processes.
	Domain 1B	Habitat structure	Typical food and water sources required by the majority of vertebrate and invertebrate inhabitants of that ecosystem type are present.
Land Use <sup>1</sup>	Domain 1B	Land use	The site can be managed for its designated land use without any greater management inputs than other land in the area being used for a similar purpose.

<sup>1</sup> - relates to the native vegetation land use option only.

A new MOP will need to be prepared (in accordance with the DRE guidelines) and approved to permit coal extraction within the Southern Extension Area. This will require a review of the domains, including the development of specific sub-domains that will address the requirements of the rehabilitation hierarchy. It is anticipated that the conceptual criteria will be adopted and developed further following consultation on the final land use within each domain with the relevant stakeholders. Furthermore, detailed closure planning, including confirmation of post-mining land uses and final rehabilitation success criteria, will be undertaken as the Project approaches five years from the planned mine closure.

#### 10.19.6 Indicative Closure Timing

The indicative closure timeline developed by GSSE (2013c) is shown in **Table 71**. It includes the following key activities:

- Closure planning;
- Decommissioning and rehabilitation;
- Maintenance and monitoring;
- Relinquishment; and
- Post relinquishment activities.

**Table 71 - Indicative Closure Timeline**

Years From Closure	Closure Planning					Decommissioning and Rehabilitation				Monitoring and Maintenance				Relinquishment	
	-5	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10
<b>Closure Planning</b>															
Stakeholder consultation regarding closure															
Agreed final detailed closure strategy															
Develop an infrastructure demolition plan															
<b>Closure Activities</b>															
Demolition of infrastructure															
Sealing of underground access areas															
Landform establishment															
Growth media establishment															
Ecosystem establishment															
Ecosystem development															
<b>Post Closure Activities</b>															
Maintenance of Rehabilitated Areas															
Monitoring and Inspections															