



# Duralie Open Pit Modification Environmental Assessment

## SECTION 5

## REHABILITATION STRATEGY



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## 5 REHABILITATION STRATEGY

The rehabilitation strategy for the approved DCM was described in Section 5 of the DEP EA.

Rehabilitation at the DCM is undertaken in accordance with the approved Rehabilitation Management Plan, Mining Operations Plan (MOP) and BMP. The results of rehabilitation initiatives undertaken to date at the DCM are documented in the Annual Review and the MOP.

### 5.1 EXISTING DCM REHABILITATION

#### 5.1.1 Rehabilitation Principles

Rehabilitation of the DCM is undertaken progressively and has the following general principles:

- to create physically and chemically stable landforms that are consistent with the local surrounding environment;
- to minimise land disturbance through progressive rehabilitation and mine planning;
- to provide visual amenity through incorporating relief into the landform design (e.g. undulating [ $\pm 20$  m] waste rock emplacement), tree and shrub establishment, mounding and/or bunding;
- to create flora and fauna corridors and habitats;
- to establish permanent, self-propagating vegetative cover; and
- to achieve final land uses that meet community and regulatory expectations and infrastructure needs in consideration of the pre-mining land use (i.e. predominately grazing) and conservation values.

#### 5.1.2 Rehabilitation Objectives

Table 5-1 describes the approved short-term, medium-term and long-term rehabilitation objectives for the DCM.

#### 5.1.3 Rehabilitation Management Plan

Rehabilitation at the DCM is conducted in accordance with the approved Rehabilitation Management Plan has been developed for the approved DCM.

### *General Rehabilitation Practices*

The Rehabilitation Management Plan describes general rehabilitation practices for the DCM, including:

- vegetation clearance measures;
- soil stripping areas and handling measures;
- plant species selection;
- erosion and sediment control works;
- weeds and pest control; and
- bushfire management.

### *Rehabilitation Monitoring*

Monitoring of rehabilitation activities at the DCM is currently undertaken in accordance with the Rehabilitation Management Plan. Rehabilitation monitoring at the DCM includes the following:

- evaluating spread topsoil profile thickness and quality prior to sowing;
- observing drains and assessment of water quality to determine whether substantial silting of inverts and/or any localised failure of the drain embankment has occurred;
- observing recently topsoiled areas after rain events (particularly on sloping ground) to determine if any significant rilling or loss of topsoil has occurred;
- assessing germination success (diversity and abundance);
- evaluating the behaviour of placed topsoil;
- assessing the degree of vegetative ground coverage achieved over time;
- assessing the survival rate for sown species by type and location;
- recording information on observations (by photographic record, file notation, etc.);
- evaluating threats posed to rehabilitated areas posed by weed infestation, feral animals, cattle, etc.; and
- land function analysis (LFA) on rehabilitated areas.

The results of rehabilitation monitoring are described in the DCM Annual Reviews.

**Table 5-1  
Approved DCM Short-term, Medium-term and Long-term Rehabilitation Objectives**

Short-term Objectives	Medium-term Objectives	Long-term Objectives
<ul style="list-style-type: none"> <li>• Minimisation of disturbance areas.</li> <li>• Conservation of sufficient soil resources for rehabilitation via appropriate soil management.</li> <li>• Provision of sediment control measures.</li> <li>• Rapid stabilisation of newly constructed infrastructure by topsoiling, seeding and fertilising.</li> <li>• Appropriate waste rock management including delineation and controlled placement of rock wastes on the basis of acid forming potential.</li> <li>• Recovery of items suitable for providing alternative habitat for displaced fauna (e.g. tree hollows).</li> <li>• Progressive backfilling of the open pit.</li> <li>• Direct placement of topsoil resources where areas on the waste rock emplacement are available for topsoil application.</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of landforms that are geotechnically stable and visually consistent with the surrounding environment.</li> <li>• Minimisation of erosion through the design and construction of contour drainage and additional sediment control dams.</li> <li>• Appropriate selection of tree and pasture species for progressive rehabilitation.</li> <li>• Encouragement of seed propagation through placement of topsoil, utilisation of soil ameliorants as required (e.g. gypsum, lime), seeding and fertilising.</li> <li>• Evaluation of availability of soil resources for rehabilitation completion by routinely calculating a soil balance.</li> <li>• Improvement of habitat in rehabilitated areas through noxious weed management, feral animal control and restriction of cattle and vehicle access.</li> <li>• Revegetation monitoring with remediation where monitoring indicates the need.</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of landforms that are geotechnically stable and visually consistent with the surrounding environment.</li> <li>• Creation of final land use of grazing and woodland habitat.</li> <li>• Reconstruction of Coal Shaft Creek using design principles which provide for long-term stability including a stable vegetative covering.</li> <li>• Management of cattle through fencing to allow controlled grazing within particular rehabilitated areas.</li> <li>• Provision of access tracks for light vehicles, tractors, etc.</li> <li>• Retention of water management infrastructure for use as agreed with the relevant landholders.</li> <li>• Decommissioning of sediment control structures if they are no longer serving an ancillary purpose (e.g. stock watering).</li> <li>• Gradual removal and decommissioning of redundant site infrastructure.</li> <li>• Maintenance of the quality of surface water runoff to appropriate standards.</li> <li>• Revegetation monitoring with remediation where monitoring indicates the need.</li> </ul>

**5.1.4 Existing DCM Rehabilitation**

Rehabilitation activities at the DCM have been undertaken in accordance with the Rehabilitation Management Plan and MOP on the southern portion of the waste rock emplacement.

Approximately 77 ha of the waste rock emplacement have been rehabilitated, with a further 7 ha shaped, dressed with topsoil and seeded.

Plate 5-1 provides examples of the success of rehabilitation at the DCM (i.e. at various stages of rehabilitation).

**5.2 REHABILITATION CONCEPTS FOR THE DCM INCORPORATING THE MODIFICATION**

The Modification involves minor changes to the layout of the approved DCM, including a minor increase in the surface development extent of the open pits and an increase in the waste rock emplacement height to approximately 135 m AHD.

In addition, the Modification is required to meet the long-term objective of creating landforms that are geotechnically stable, as a component of the Modification involves a reduction in low wall angles of the Clareval open pit to improve geotechnical stability (Section 3.2).



Duralie Coal Mine Waste Rock Emplacement looking North-East



Duralie Coal Mine Waste Rock Emplacement Revegetation at 9 months



Duralie Coal Mine Waste Rock Emplacement looking West



Duralie Coal Mine Waste Rock Emplacement Revegetation at 18 months

**DURALIE OPEN PIT MODIFICATION**

**PLATE 5-1**

Duralie Coal Mine Rehabilitation



The proposed post-rehabilitation general arrangement of the DCM incorporating the Modification is shown on Figure 5-1.

In general the modified DCM would not change the approved DCM rehabilitation principles, objectives and concepts. Notwithstanding, the Rehabilitation Management Plan would be revised to incorporate the Modification.

### 5.2.1 Final Landform and Revegetation Concepts

Consistent with the approved DCM, the final landforms at the completion of mining for the modified DCM would include:

- final voids in the Weismantel and Clareval open pits;
- integrated in-pit and out-of-pit waste rock emplacement landform;
- reconstructed Coal Shaft Creek Diversion;
- water management infrastructure; and
- decommissioned site infrastructure areas.

The following sub-sections summarise the rehabilitation concepts for these key final landforms.

### 5.2.2 Weismantel and Clareval Open Pits

The Modification would result in minor changes to the sizes of the final voids, consistent with the proposed changes to the open pits (Section 3.5).

Consistent with the approved DCM, the following rehabilitation activities would be undertaken for the final voids:

- restriction of access (e.g. safety bunding and/or fencing and installation of signage);
- further geotechnical assessment would be undertaken to assess geotechnical stability and provide recommendations for the reshaping of final highwalls and endwalls; and
- vegetation would be established around the perimeter of the open pit voids to provide visual screening.

The revised final void water balance conducted by Gilbert & Associates (2014) for the Modification indicates the final voids would slowly fill over time and the final water levels in the Clareval open pit and Weismantel open pit would stabilise below the spill levels, consistent with the predictions for the DEP (Section 3.5).

### 5.2.3 Waste Rock Emplacement

The Modification involves an increase in the height of the waste rock emplacement to approximately 135 m AHD.

Consistent with the approved DCM, the rehabilitation strategy for the modified DCM waste rock emplacement involves:

- management of PAF material in accordance with existing site practices (Section 3.2.8);
- grading the final surface of the waste rock emplacement to blend in with the natural topography of the area;
- maintenance of operational erosion and sediment controls until establishment of stable final landforms;
- installation of drainage works (e.g. contour drains) and ponds to channel runoff safely to constructed outlet areas; and
- progressive rehabilitation of outer batters.

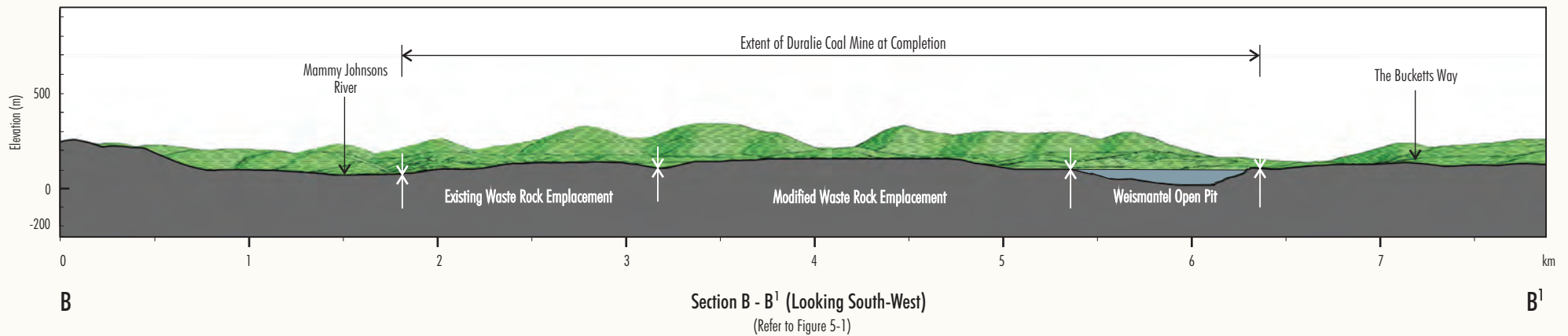
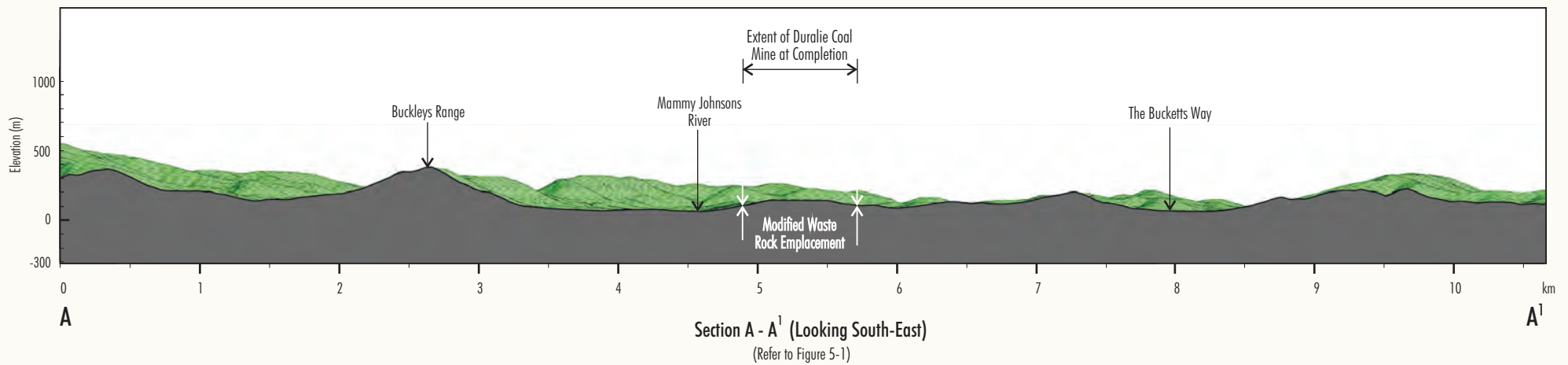
Figure 5-2 provides conceptual cross-sections of the DCM final landform, including for the modified waste rock emplacement. As shown, the final DCM landform includes significant topographic relief and is compatible, in terms of relief and elevation, with the surrounding landscape.

### Water Management



There would be no changes to the water management strategy for the waste rock emplacements as a result of the Modification which includes:

- surface water runoff flows down the slope of each batter to the toe where it would be redirected by contour drains;
- rock-lined channels (or other appropriate erosion control treatment), where required;
- retaining sediment dams downstream of the waste rock emplacement until the runoff water quality is similar to runoff from similar catchments; and
- construction of clay cut-off walls along the southern end of the toe of the waste rock emplacement to reduce direct seepage out of the waste rock emplacement to negligible levels.





**LEGEND**

-  Section of Figure 5-1
-  Background Topography of Section (to approximately 4 km)

Source: Marc & Co (2014)

**DURALIE OPEN PIT MODIFICATION**

**FIGURE 5-2**  
Conceptual Sections  
of the Gloucester Basin  
Post-Mining





## Revegetation

There would be no change to the approved revegetation objectives for the waste rock emplacement as a result of the Modification, which would include areas of woodland and pasture on the waste rock emplacement surface and batters.

The woodland areas would be linked to a broader habitat enhancement strategy as discussed in Section 4.5. In addition, trees would be established around the perimeter of the reprofiled waste rock emplacement to facilitate screening of potential views of the final DCM landform.

The conceptual post-rehabilitation revegetated landforms and biodiversity offset are shown on Figure 5-3.

### 5.2.4 Coal Shaft Creek

There would be no change to the approved rehabilitation of the Coal Shaft Creek diversion as a result of the Modification (Figure 5-1).

### 5.2.5 Water Management Infrastructure

There would be no changes to the rehabilitation of water management infrastructure (e.g. MWD and Auxiliary Dams) as a result of the Modification.

Consistent with the approved DCM, rehabilitation of water management infrastructure would occur in consultation with regulatory authorities and the community, and considering future local and regional water infrastructure needs. Site water dams (e.g. MWD, Auxiliary Dams) and accompanying upstream diversion structures may be retained for future use. Sediment dams would remain pending long-term acceptable water quality and may be kept for stockwater if suitable. Irrigation infrastructure owned by DCPL would be decommissioned, unless used for post-mining agricultural use.

### 5.2.6 Site Infrastructure

There would be no change to the decommissioning and rehabilitation of site infrastructure as a result of the Modification, which would include the removal of the following infrastructure at the end of the mine life:

- workshop buildings and stores<sup>1</sup>;
- heavy vehicle servicing, parking and washdown facilities;
- sewage treatment facilities<sup>1</sup>; and
- dangerous goods storage facilities.

## 5.3 INTEGRATION WITH THE MODIFICATION OFFSET STRATEGY

### 5.3.1 Existing Biodiversity Offset

DCPL has established the approved offset areas on DCPL owned land to the west and south-east of the DCM (i.e. the Northern and Southern Offset Areas) (Figure 5-3). The approved biodiversity offset areas have a combined area of approximately 680 ha. The approved offset areas would provide wildlife corridors across the valley.

Works within the approved offset areas are conducted in accordance with the BMP.

### 5.3.2 Proposed Biodiversity Offset

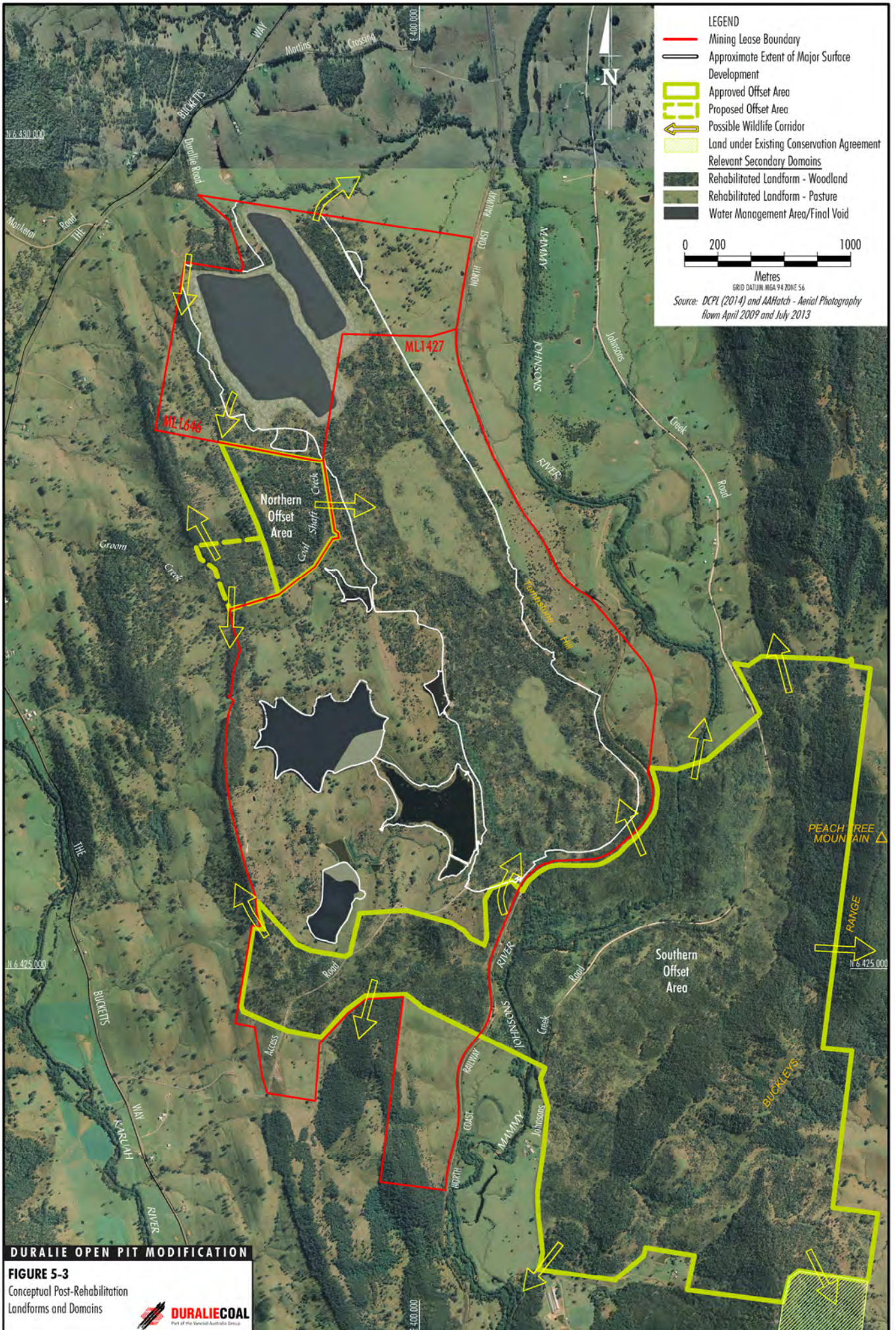
DCPL proposes to extend the Northern Offset Area to include an additional 12.5 ha of land for the Modification (Figure 5-3). Within the proposed biodiversity offset area, existing native vegetation communities would be enhanced (approximately 9 ha) and cleared land would be revegetated (approximately 3.5 ha).

Consistent with the existing biodiversity offset areas, and existing DCM Project Approval, the proposed biodiversity offset area would be perpetually conserved.

Justification for the proposed biodiversity offset area and its ecological benefits is provided in Section 4.5.4.

The approved BMP would be revised to incorporate the Modification.

<sup>1</sup> Some infrastructure (e.g. buildings, stores or sewage treatment facilities) may be retained if required for post-mine land use.



#### 5.4 MINE CLOSURE AND LEASE RELINQUISHMENT

No change to the closure of the DCM or relinquishment of ML 1427 and ML 1646 is expected as a result of the Modification.

In general accordance with *Leading Practice Sustainable Development Program for the Mining Industry - Mine Closure and Completion* (Department of Industry, Tourism and Resources, 2006b), a comprehensive monitoring regime would be established to track the progress of rehabilitation initiatives towards the fulfilment of the rehabilitation objectives.

Upon cessation of mining operations, it would be expected that tenure of ML 1427 and ML 1646 would be maintained by DCPL until such time as the relevant statutory requirements are achieved (e.g. fulfilment of mining lease conditions). DCPL would then seek to relinquish the mining leases.

Central to lease relinquishment would be the confirmation of safety issues and the demonstrated application of adequate control measures to facilitate sustainable landscapes. Assessment of rehabilitation success (i.e. in accordance with established completion criteria) would be conducted in consultation with relevant authorities and stakeholders.

#### 5.4.1 Rehabilitation Completion Criteria

Rehabilitation completion criteria for the DCM are described in Table 5-2. No changes to these rehabilitation completion criteria are expected for the Modification. If necessary, rehabilitation completion criteria would be reviewed and refined closer to the completion of the mining activities at the DCM.

#### 5.5 CONCEPTUAL REHABILITATION DOMAINS

The approved DCM rehabilitation concepts are considered to be generally consistent with the rehabilitation domain objectives described in the *ESG3: Mining Operations Plan (MOP) Guidelines* (DRE, 2013). It is expected the following conceptual rehabilitation domains would be relevant to the modified DCM:

- Final Void;
- Water Management Area;
- Rehabilitated Landform – Woodland; and
- Rehabilitated Landform – Pasture.

The approved DCM rehabilitation concepts would be reviewed in accordance with the rehabilitation domain objectives described in the *ESG3: Mining Operations Plan (MOP) Guidelines* (DRE, 2013) in the revised MOP for the Modification.

**Table 5-2  
Rehabilitation Completion Criteria**

Modification Component	Rehabilitation Completion Criteria
Final Landforms	<ul style="list-style-type: none"> <li>• Safe, stable, adequately drained post-mining landforms consistent with the surrounding landscape as evidenced by comparative photography, water quality monitoring and geotechnical surveys.</li> <li>• Geomorphic stability of drainage features comparable to existing natural drainage features as evidenced by cross-section and long-section surveys and monitoring of erosion.</li> </ul>
Final Voids	<ul style="list-style-type: none"> <li>• Surface water inflows to the final voids minimised through appropriate landforming as evidenced by revision of the water balance based on final as-built mine landforms.</li> <li>• Final voids profiled for long-term stability as evidenced by geotechnical surveys of high walls/end walls.</li> <li>• Perimeter bunding formed.</li> </ul>
Rehabilitation and Revegetation Areas	<ul style="list-style-type: none"> <li>• Woodland/riparian areas on trajectory toward self-sustaining ecosystem<sup>1</sup> and/or measures of ecosystem function (e.g. vegetation cover, landform stability, species diversity) equivalent to reference sites.</li> </ul>
Grazing Areas	<ul style="list-style-type: none"> <li>• Stocking rates of between 1.5 and 4.0 dry sheep equivalents (DSE) per hectare (average 2.8 DSE) in accordance with <i>Beef Stocking Rates and Farm Size - Hunter Region</i> (DPI, 2006) (Native unimproved pasture – moderate fertility [no seed or fertiliser added]) as evidenced by monitoring of grazing productivity.</li> </ul>

<sup>1</sup> As measured by LFA or a similar systems-based approach.