



APPENDIX F
Rehabilitation Proposal

**COWAL GOLD OPERATIONS
MINE LIFE MODIFICATION**
Environmental Assessment
2016



COWAL GOLD OPERATIONS MINE LIFE MODIFICATION
REHABILITATION PROPOSAL



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1 INTRODUCTION

The Cowal Gold Operations (CGO) is an open cut gold mining operation located approximately 38 kilometres (km) north-east of West Wyalong, New South Wales (NSW) (Figure 1). Evolution Mining (Cowel) Pty Limited (Evolution) is the current owner and operator of the CGO. The CGO has been operating since 2005 within Mining Lease (ML) 1535 and is approved under Development Consent (DA 14/98) to operate until 31 December 2024.

The CGO open pit has been developed in stages as the ore body is progressively mined via widening and deepening of the open pit. Waste rock and ore is broken through a routine sequence of in-pit drilling and blasting. Broken waste rock is placed in a continuous waste rock emplacement surrounding the open pit consisting of the northern, southern and perimeter waste rock emplacements, or, in the case of ore, direct to the primary crusher (adjacent the process plant), run-of-mine (ROM) pads or to the low grade ore stockpile (Figure 2). The perimeter waste rock emplacement forms part of the lake isolation system, which includes a series of embankments (i.e. temporary isolation bund and lake protection bund) between the open pit and Lake Cowal (Figure 2). Tailings are delivered from the process plant via a pipeline for storage in two tailings storage facilities (TSFs) located approximately 3.5 km west of the Lake Cowal shoreline (Figure 2).

Environmental management at the CGO is undertaken in accordance with a range of approved environmental management plans, procedures and environmental monitoring programmes. The CGO's Environmental Management System is certified under the International Standard ISO 14001.

This Rehabilitation Proposal has been prepared to support the *Cowel Gold Operations Mine Life Modification Environmental Assessment* (Evolution, 2016a) and provides an overview of rehabilitation at the CGO to date and provides a detailed description of the rehabilitation concepts and activities for the proposed CGO Mine Life Modification.

1.1 MODIFICATION OVERVIEW

Evolution is seeking approval to modify the CGO Development Consent (DA 14/98) to extend the life of the CGO by approximately 8 years (i.e. to the end of 2032) by accessing gold-bearing ore at depths greater than the currently approved final depth of the existing open pit (herein referred to as the Modification).

The main activities associated with the development of the Modification would include:

- increasing the final depth of the open pit by 70 metres (m) to enable mining of additional ore and an increase in total gold production;
- extending the life of the approved CGO by up to 8 years, to 31 December 2032;
- upgrades to the existing leach circuit within the processing plant to improve gold recovery;
- increasing the total life of mine ore production/volume of tailings and mined waste rock;
- maximising tailings storage capacity of the existing TSFs via additional lifts and converting the area between the existing TSFs into a new storage area;
- incorporation of a rock fill buttress cover on the outer slopes of the TSF embankments to provide long-term stability; and
- an increase to the TSF embankment lift fleet.

The key changes to the approved CGO layout as a result of the Modification are shown on Figure 3.

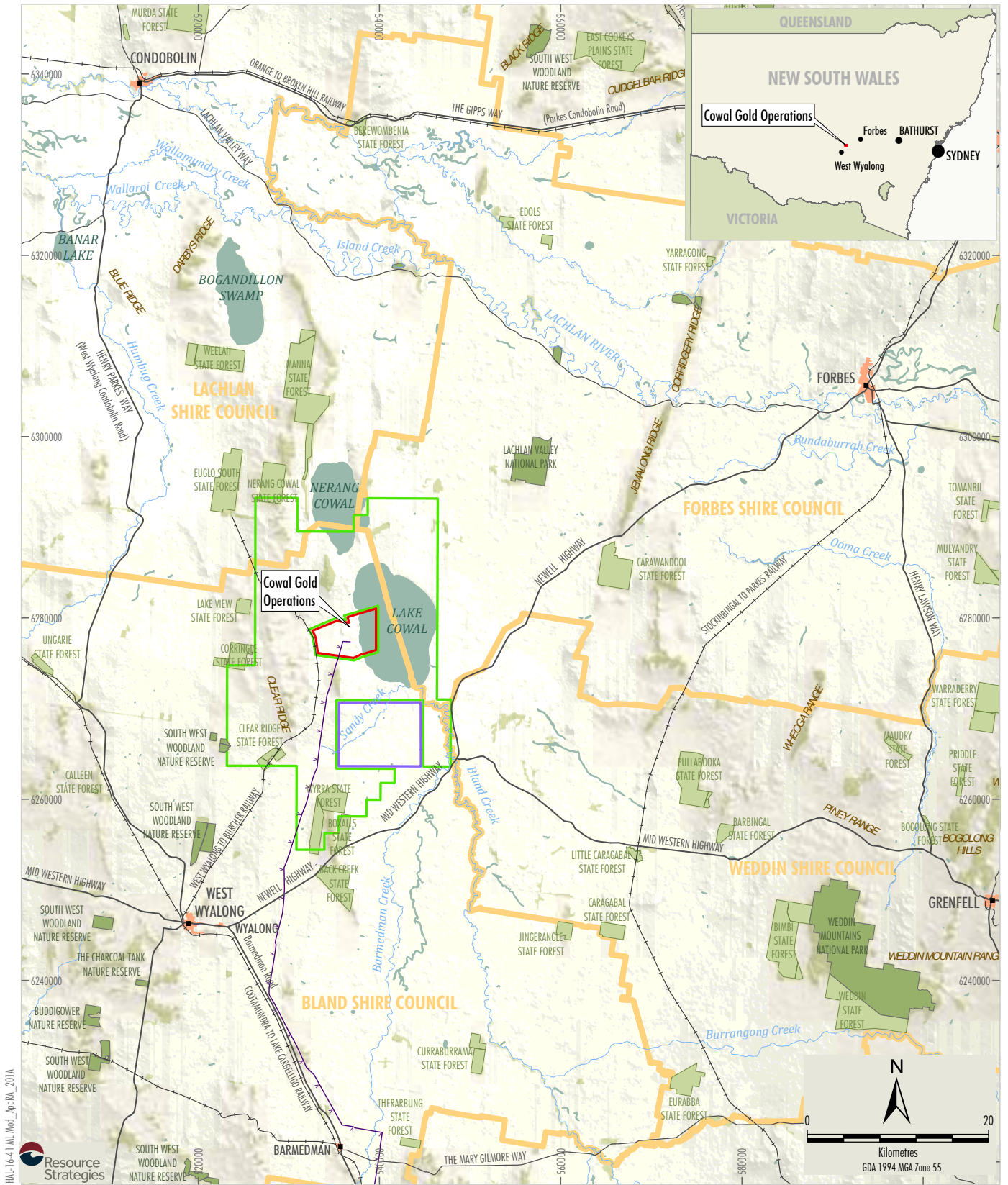
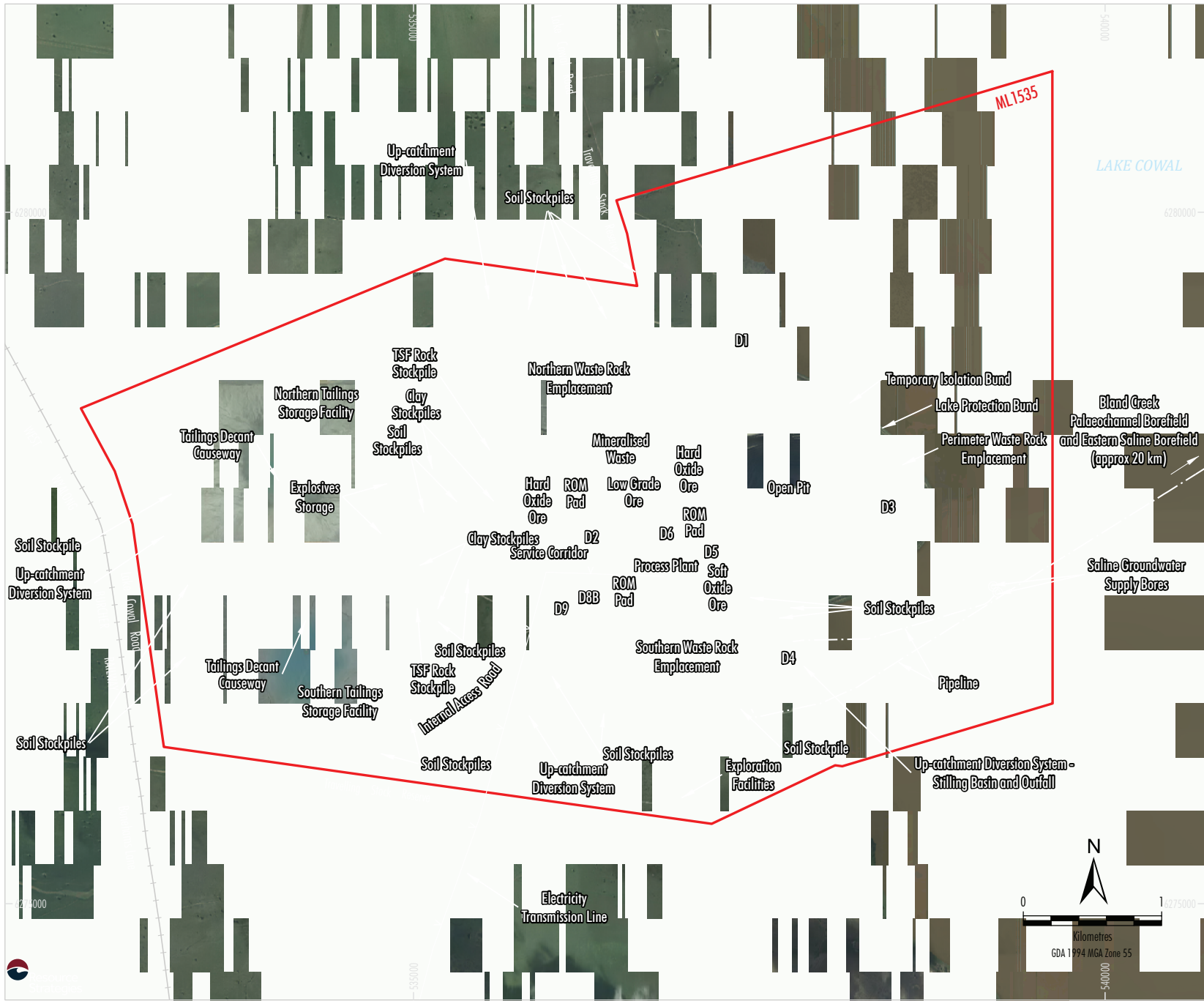


Figure 1



LEGEND
 Mining Lease Boundary (ML 1535)

Source: Evolution - Orthophoto (August 2016)

CGO MINE LIFE MODIFICATION
 Current Status of CGO

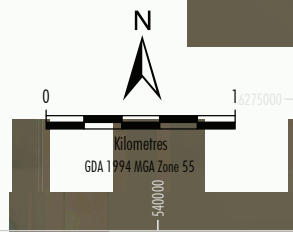
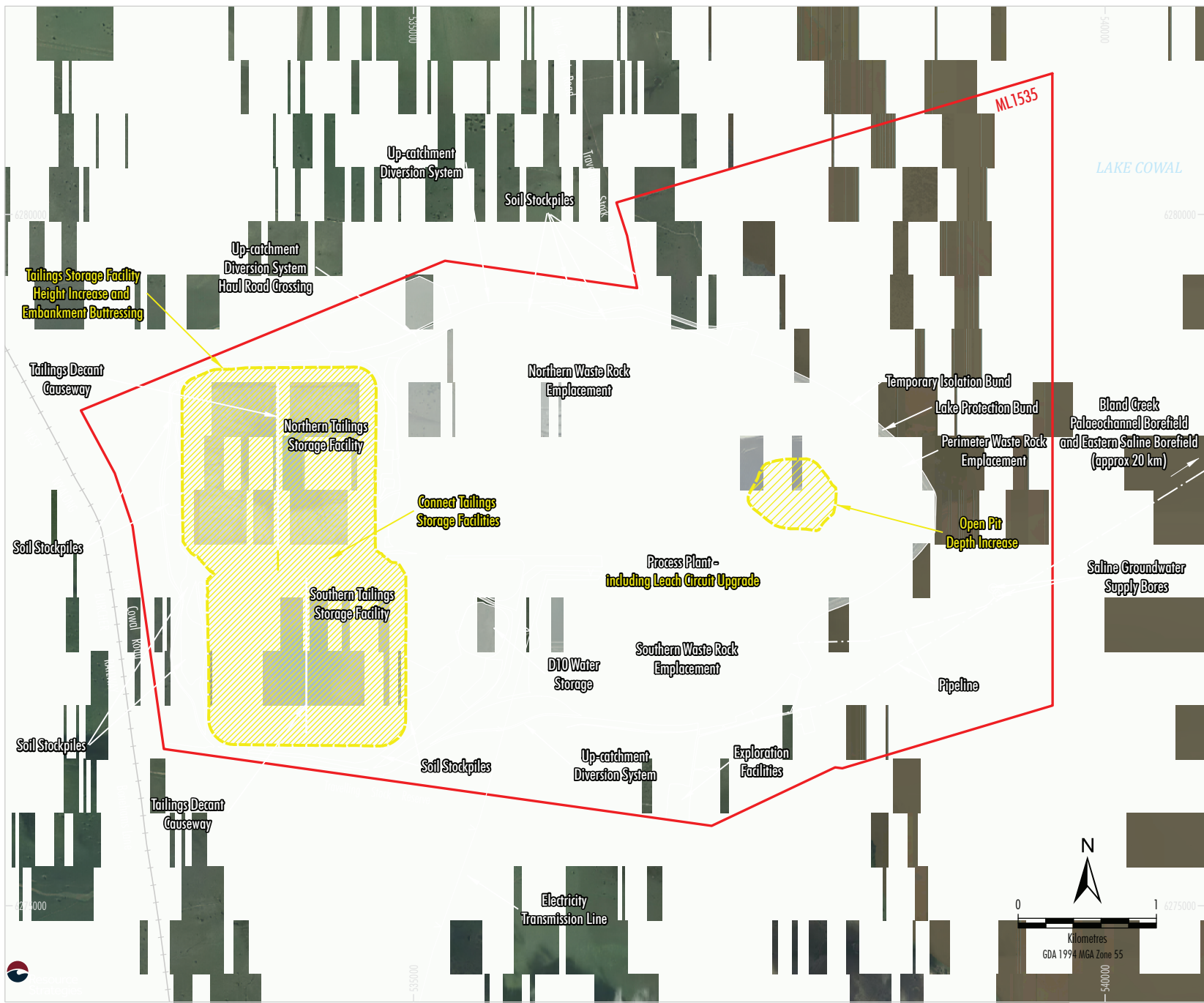


Figure 2



- LEGEND**
- Mining Lease Boundary (ML 1535)
 - Approximate Extent of Approved Surface Development
 - Modification Components

Source: Evolution - Orthophoto (August 2016)

CGO MINE LIFE MODIFICATION
Modification General Arrangement

Figure 3

The Modification would not change the following key components of the existing CGO:

- mining tenement;
- lake isolation system;
- surface development extent;
- water management system and design objectives;
- mining methods;
- ore processing rate;
- waste rock emplacement footprints or maximum design heights;
- cyanide destruction method;
- approved cyanide concentration limits in the aqueous component of the tailings slurry;
- water supply sources;
- approved daily or annual extraction limits of the Bland Creek Palaeochannel Borefield;
- site access road;
- power supply;
- exploration activities;
- peak annual employment;
- hours of operation; or
- TSF embankment construction hours of 7:00 am to 6:00 pm.

1.2 PURPOSE AND STRUCTURE OF THIS REPORT

As described in Section 1, this document provides an overview of rehabilitation at the CGO to date and outlines the rehabilitation proposal for the Modification.

The remainder of this Rehabilitation Proposal is structured as follows:

- Section 2: Provides a description of the status of rehabilitation at the CGO and the results and findings of rehabilitation investigations and trials undertaken to date. This section also describes the approved final landform design concepts and long-term land use strategy.
- Section 3: Outlines the rehabilitation proposal for the Modification.
- Section 4: Describes the mine closure strategy and lease relinquishment criteria.
- Section 5: Lists the references cited in this report.

2 REHABILITATION AT THE CGO

This section provides a summary of the status of rehabilitation at the CGO and a description of the approved final landform design concepts, and the CGO's long-term land use strategy. This section also details the results of rehabilitation investigations and trials undertaken at the CGO to date.

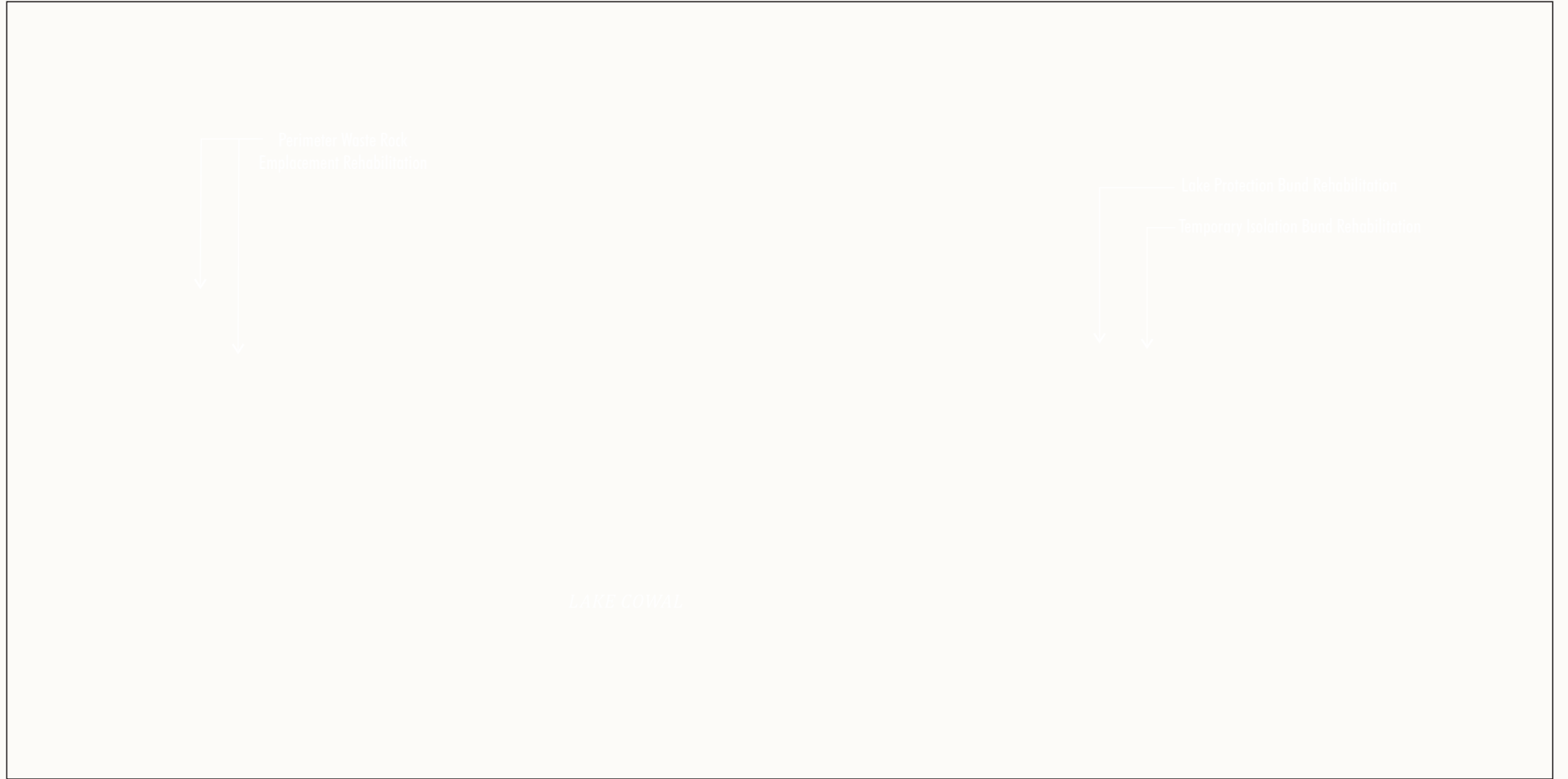
2.1 STATUS OF REHABILITATION

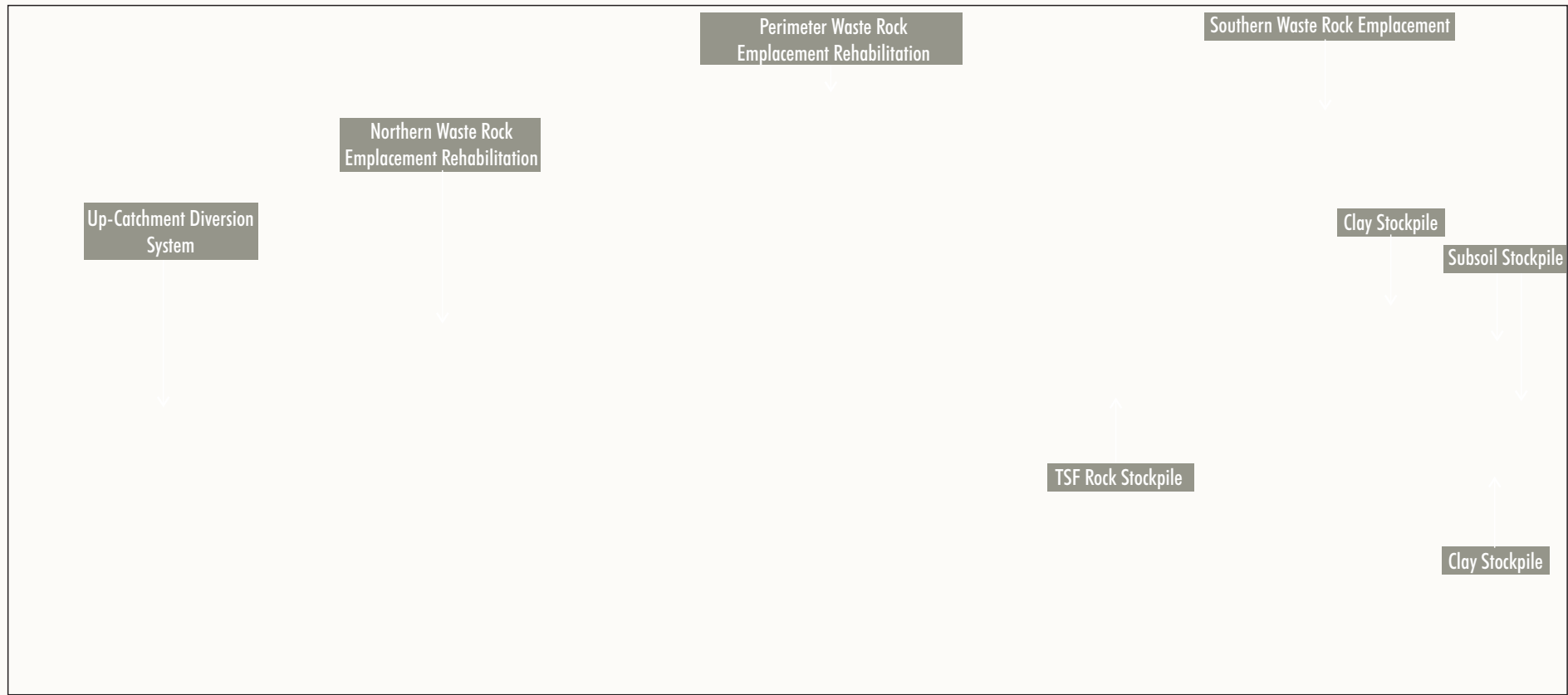
Approximately 330 hectares (ha) of land within ML 1535 is under rehabilitation (i.e. either shaped and covered [i.e. with rock armour, topsoil and revegetation] or rehabilitated and under maintenance) (Evolution, 2016b). Areas currently under rehabilitation include:

- temporary isolation bund (shaped, topsoiled and revegetated with native and exotic tree and grass species including scattered aquatic species such as Lignum [*Muehlenbeckia florulenta*], Rush [*Eleocharis* sp.], River Cooba [*Acacia stenophylla*] and River Red Gum [*Eucalyptus camaldulensis*]);
- lake protection bund (shaped and lower batter rock armoured, topsoiled and revegetated with native and exotic tree and grass species including scattered aquatic species such as Lignum, Rush sp., River Cooba and River Red Gum);
- Up-catchment Diversion System (UCDS) (rehabilitated and under maintenance);
- components of the Internal Catchment Drainage System (ICDS) (e.g. surface water diversion structures) (rehabilitated and under maintenance);
- northern and southern TSFs (embankments shaped and rock armoured with some areas topsoiled [with gypsum] and revegetated with native and exotic grass species);
- perimeter waste rock emplacement lower and majority of upper outer batter slopes of southern and eastern sections (shaped, rock armoured and topsoiled [with gypsum] with revegetation including native and exotic grass species establishing across majority of rehabilitation area);
- southern waste rock emplacement lower, mid and upper outer batter slopes of southern section and lower slopes of eastern section (shaped, rock armoured and topsoiled [with gypsum] with revegetation including native and exotic grass species establishing across rehabilitation area);
- northern waste rock emplacement north facing lower, mid and upper outer batter slopes (shaped, rock armoured and topsoiled [with gypsum] with revegetation including native and exotic grass species established across northern extent of the rehabilitation area (and plantings of Eucalypt and Acacia species established across the rehabilitation trial area);
- embankments of contained water storage D9 (shaped, rock armoured, topsoiled and revegetated with native and exotic grass species); and
- Bland Creek Palaeochannel Borefield water supply pipeline (rehabilitated and under maintenance).

Plates 1 to 4 include recent photographs of rehabilitation progress at the CGO, including the:

- perimeter waste rock emplacement, lake protection bund and temporary isolation bund rehabilitation (July 2016) (Plate 1);
- southern waste rock emplacement rehabilitation (July 2016) (Plate 2);
- northern waste rock emplacement rehabilitation (June 2016) (Plate 3); and
- perimeter and southern waste rock emplacement and temporary isolation bund rehabilitation (June 2016) (Plate 4).









An overview of existing rehabilitation areas and current rehabilitation trial areas is shown on Figure 4.

Additional photographs of rehabilitation trials performance and rehabilitation activities undertaken at the CGO to date are provided in Section 2.4.

2.2 FINAL LANDFORM DESIGN CONCEPTS

The currently approved final landform design concepts listed below would remain unchanged for the Modification.

The final landforms would be:

- designed wherever possible to be compatible with regional landscape features;
- progressively constructed as a ROM operation wherever possible and left with untrimmed surface roughness to lower runoff coefficients and promote water absorption and storage; and
- revegetated with endemic vegetation communities, selected specifically for their suitability to the created elevation, aspect, substrate conditions and the overriding objective of re-establishing a greater extent of endemic vegetation within ML 1535.

The rehabilitation concepts and objectives for the CGO final landforms (including the waste rock emplacements, TSFs, open pit, New Lake Foreshore, site infrastructure areas and the woodland corridor) would remain unchanged for the Modification and would be applied to the modified landforms (i.e. the modified TSFs and open pit/final void). These concepts and objectives are described in Section 3.

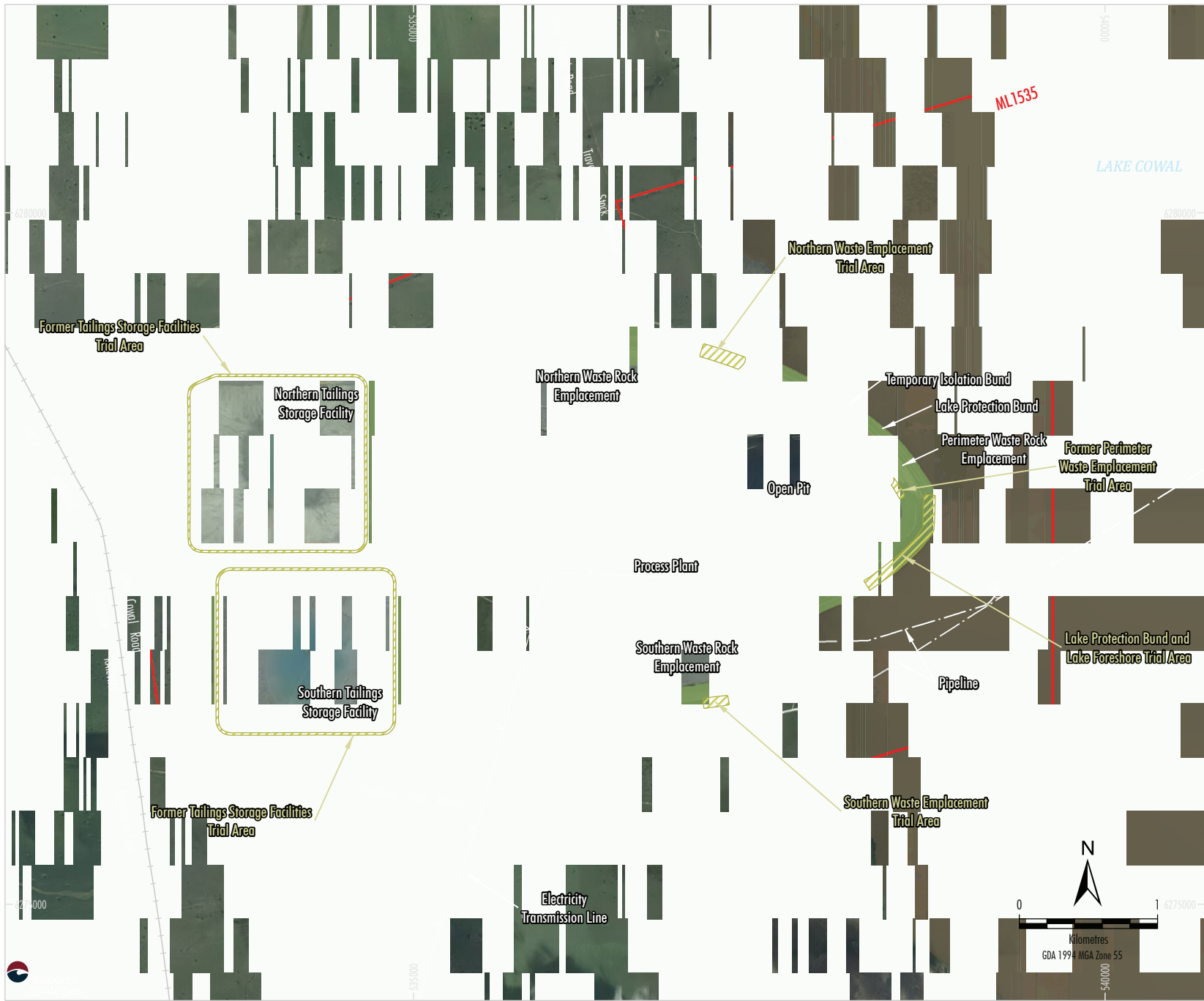
2.3 LONG-TERM LAND USE STRATEGY

In accordance with Development Consent (DA 14/98) Condition 3.8, a long-term land use strategy has been developed for the CGO (Barrick, 2013a). The strategy is relevant to land within ML 1535, the Bland Creek Palaeochannel water supply pipeline and borefield and Eastern Saline Borefield (Figure 2) and Evolution-owned land outside ML 1535.

The strategy would remain unchanged for the Modification. A conceptual view of the proposed long-term land use areas is shown on Figure 5.

At lease relinquishment, it is proposed that land use within the ML 1535 area would include fenced rehabilitation areas with grazing excluded and areas suitable for agricultural production including commercial and recreational fishing of lake areas or managed grazing by livestock (Figure 5).

Consistent with the CGO's Land Management Plan (LMP), at lease relinquishment, areas of Evolution-owned land (with the exception of the Compensatory Wetland and Northern and Southern Offset Areas) (Figure 5) would continue to be used for farming/agricultural production by Evolution and/or licensees that sign agreements to conduct agricultural activities on Evolution-owned land. It is anticipated that areas of lakebed country would be available for commercial and recreational fishing when inundated, and may be used for cropping and/or managed livestock grazing when dry, consistent with existing and historical uses of Lake Cowal. In accordance with the LMP, the Remnant Vegetation Enhancement Programme (RVEP) Areas (Figure 5) would continue to be maintained for the term of Evolution's tenure of the land.



LEGEND

- Mining Lease Boundary (ML 1535)
- Rehabilitation Trial Area
- Partially Rehabilitated (Shaped and Covered)

Source: Evolution - Orthophoto (August 2016)

CGO MINE LIFE MODIFICATION
2016 CGO Rehabilitation

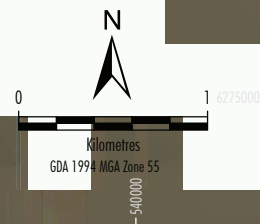


Figure 4



CGO MINE LIFE MODIFICATION
 Conceptual Final Landform and
 Proposed Final Land Use Areas

Figure 5

Some infrastructure may be retained and transferred to local landholders for use following lease relinquishment, including electricity infrastructure, water storages, pipelines, bores and associated pump stations, if agreed with the Department of Industry, Skills and Regional Development's Division of Resources and Energy (DRE). If it is agreed with the DRE and the ultimate landholder that the CGO's Bland Creek Palaeochannel Borefield, Eastern Saline Borefield and the saline groundwater bores within ML 1535 are to be retained for local use, the pipelines would remain in place. Alternatively, if the infrastructure is not required for local use, the bores would be plugged, capped and decommissioned in accordance with relevant regulatory guidelines, the pump stations would be removed and the pipelines raised (when the lake is dry) and dismantled for recycling.

A description of the long-term land use areas is provided below.

Rehabilitation Areas

Rehabilitated final landforms including the waste rock emplacements, TSFs, final void, Compensatory Wetland, former process plant area (including decommissioned and rehabilitated contained water storages) will be fenced with grazing excluded, with some areas suitable for grazing surrounding the rehabilitated final landforms (Figure 5).

Consistent with rehabilitation concepts provided in the *Cowan Gold Mine Environmental Impact Statement* (the EIS) (North Limited, 1998), a woodland corridor will also be provided between the rehabilitated northern waste rock emplacement and the rehabilitated northern TSF (Figure 5). Exclusion of grazing of these areas is proposed to protect revegetation and natural regeneration and to maintain the long-term stability of the final landforms.

Permanent drainage features within ML 1535 including the UCDS and drainage lines associated with the permanent catchment divide would remain to manage surface water runoff around the rehabilitated CGO area.

Areas Suitable for Grazing/Agricultural Production

The remaining areas of land within ML 1535 level with the natural ground surface disturbed by mining operations (e.g. former infrastructure areas) would be rehabilitated to include vegetation which expands on the areas of remnant endemic vegetation that currently exists in the region and include native pasture species. It is expected that once sufficiently mature vegetation communities have been established, these areas would be suitable for managed livestock grazing (Figure 5).

A suitable stocking rate for these areas would be determined in consultation with the relevant regulatory authorities based on the performance of the revegetation following closure of the mine. The relocated travelling stock reserve formed around the western boundary of ML 1535 (Figure 5) would be retained.

Long-term land uses would ultimately be subject to consultation with relevant regulatory authorities (including the NSW Department of Planning and Environment, DRE, NSW Environment Protection Authority [EPA], NSW Office of Environment and Heritage (OEH), NSW Department of Primary Industries-Water [DPI-Water] and DPI – Fisheries) and key stakeholders including surrounding landholders.

CGO Offset Areas and RVEP Areas

Consistent with Development Consent Condition 3.4(b) and the CGO's approved Biodiversity Offset Management Plan, long-term protection of the CGO Offset Areas would be provided by a Voluntary Planning Agreement registered on the title of the offset lands. Consistent with the CGO's approved LMP, management of the RVEP areas would be maintained for the term of Evolution's tenure of the relevant lands.

2.4 RESULTS OF REHABILITATION INVESTIGATIONS AND TRIALS

Numerous rehabilitation investigations and trials have been undertaken at the CGO to determine the most appropriate and effective rehabilitation methods, rehabilitation materials and revegetation species likely to achieve the rehabilitation objectives for the CGO's final landforms.

Rehabilitation investigations and trials that have been undertaken since 2005 have focussed on the following key aspects relevant to the CGO:

- **Rehabilitation Media**
 - Investigations and trials assessing the effectiveness of different surface treatments (e.g. native pasture hay, woodchips and rock mulch) and substrate types (e.g. oxide waste, subsoil and topsoil) in stabilising landform slopes.
 - Investigation into the geochemical suitability of rock armouring on the outer batters of mine landforms.
- **Water Management and Erosion Control on Landform Slopes**
 - Investigation into water management and erosion control concepts including hydrological and hydraulic modelling of different CGO landform slope designs (i.e. single slope compared with tiered slope) and different surface treatments (i.e. with or without rock mulch) under various rainfall events.
- **Material Characterisation and Amelioration**
 - Investigation into the chemical and physical properties of topsoil and subsoil resources and the optimum rates of gypsum application to improve suitability for plant growth and use on rehabilitation areas.
- **Revegetation**
 - Ongoing trials and research to determine the most appropriate revegetation species suited to substrate materials of the CGO's final landforms.

An overview of the results from the investigations and trials listed above is provided in the Sections 2.4.1 to 2.4.4.

2.4.1 Rehabilitation Media

As described in the EIS (North Limited, 1998), results of the *Cowal Gold Project Soil, Agricultural Suitability/Land Capability and Soil Resources* (NSW Department of Conservation and Land Management [DCLM], 1994) identified that within ML 1535 soils have structural problems (i.e. are dispersive), are generally saline and sodic, low in organic matter, and have moderate to high erodibility. Based on these characteristics, soils were assessed as having moderate to low suitability as a revegetation medium (DCLM, 1994).

As a result, since construction of the CGO commenced in 2005, a series of rehabilitation investigations and field trials have been established on various CGO landforms (including different slopes and aspects) to determine the effectiveness of various surface treatments in stabilising rehabilitation media and landform slopes and supporting long-term vegetation growth.

Since 2005, numerous rehabilitation trial areas have been established on batters of the following CGO landforms to assess the performance of various surface treatments:

- northern and southern TSFs;

- lake protection bund and new lake foreshore;
- perimeter waste rock emplacement;
- southern waste rock emplacement; and
- northern waste rock emplacement.

Figure 4 shows the location of current and former rehabilitation trial areas at the CGO.

A summary of the results of the rehabilitation trials undertaken to date is provided below.

Northern TSF and Lake Protection Bund

In 2005, rehabilitation trial areas were established on batter slopes of the northern TSF and on the lake protection bund to assess the effectiveness of treatments including straw mulch and rye-corn using a combination of Landscape Function Analysis (LFA) and laboratory monitoring measurements. The trial was the subject of an Australian National University Honours project titled *The Effectiveness of Mulch and Cover Crops in Stabilising Sloping Rehabilitation Areas at Cowal Gold Project* (Summerfield, 2006).

The main findings of the study were (Summerfield, 2006):

- the mulch treatments had higher stability, infiltration and nutrient cycling index values compared to the rye-corn treatments, however, the LFA indices for both these treatments were lower than those of the analogue site;
- low levels of organic matter and high levels of exchangeable sodium were found in the soils on both the northern TSF and the lake protection bund;
- the application of straw mulch had beneficial effects (such as minimising erosion and soil loss during rainfall events); and
- application of gypsum would be required to ameliorate the sodic properties of the soil.

A rehabilitation trial area was then established on the inner batters of the perimeter waste rock emplacement in 2006 to expand on the study undertaken by Summerfield (2006). A description of the results from this trial is provided below.

Perimeter Waste Rock Emplacement

A rehabilitation trial was established on a section of the inner batter of the perimeter waste rock emplacement in 2006. The trial was also the subject of an Australian National University Honours thesis titled *The Effectiveness of Different Mulches in Mine Rehabilitation: Short-term Effects on the Surface Stability and the Conditions for Plant Growth, Cowal Gold Mine, NSW* (Smits, 2008). The objective of the trial was to determine the effectiveness of the following surface covers in stabilising the perimeter waste rock emplacement batters (Smits, 2008; DnA Environmental, 2010):

- scattered timber;
- cattle manure;
- local pasture hay;
- woodchips;
- rock mulch;

- lucerne hay; and
- no cover (control).

Plate 5 shows photos of the surface cover treatment trial plots in September 2007 and March 2010.

Results from the trial indicated that all surface treatments (except for scattered timber) significantly improved the conditions for plant growth, improved landscape function and produced satisfactory short-term erosion control compared to the control (Smits, 2008). The photographs clearly show that protective ground cover is critical in stabilising the slope and that increased plant establishment has occurred in mulches with high organic (and seed) content, such as the local pasture hay and lucerne hay treatments (DnA Environmental, 2010).

Based on the outcomes of these trials, additional larger scale trials have been conducted on the northern and southern TSFs and the southern and northern waste rock emplacements to identify surface treatments that can provide rapid stability, improve the function of the plant growth media and provide long-term ecosystem sustainability of the rehabilitation areas. These trials are described below.

Northern and Southern TSFs

Large scale rehabilitation trial areas were established on north, south, east and west facing batters of both the northern and southern TSFs in 2009. The objective of the trials was to compare the effectiveness of various surface treatments (and treatment combinations) in establishing and sustaining native grassland vegetation communities (DnA Environmental, 2010; 2013a) consistent with the rehabilitation objectives for the TSF batter slopes (Section 3.3.4).

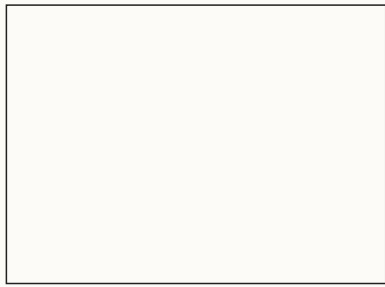
The surface treatments trialled on the TSF batters included (DnA Environmental, 2010; 2013a):

- wood mulch/pallets and cardboard;
- rock ribbons (approximately 5 m apart);
- rock ribbons (approximately 5 m apart) and clean wheaten hay;
- rock mulch (approximately 300 millimetres [mm] deep) cross-ripped with topsoil;
- rock mulch (approximately 300 mm deep) cross-ripped with topsoil and woodchips;
- loose rock;
- site produced bioremediation solids;
- biosolids (applied at 15 tonnes per hectare [t/ha], 25 t/ha and 45 t/ha);
- topsoil covered with woodchips;
- topsoil covered with clean wheaten hay; and
- topsoil.

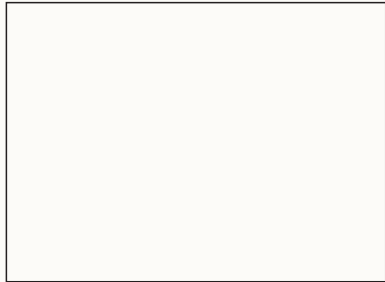
Plate 6 shows photos of the trial plots on TSF batters in March 2010, approximately one year after establishment of the trial.

A preliminary assessment of the performance of these treatments (based on stability, vegetation cover and species diversity) was prepared by DnA Environmental (2010) and is summarised in Table 1.

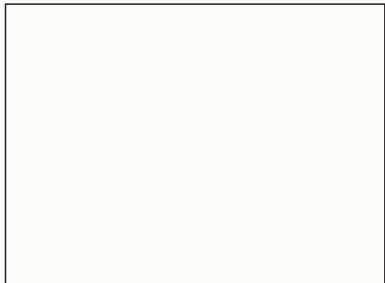
	Woodchips	Pasture Hay	Rock	Lucerne	Timber	Cattle Manure	Control
September 2007							
March 2010							



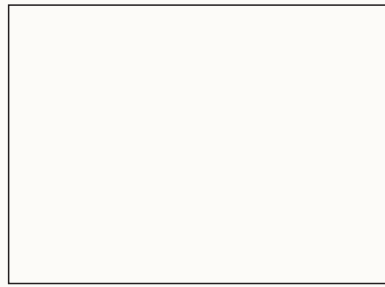
Wood Mulch/Pallets and Cardboard
(Suppressed vegetation growth)



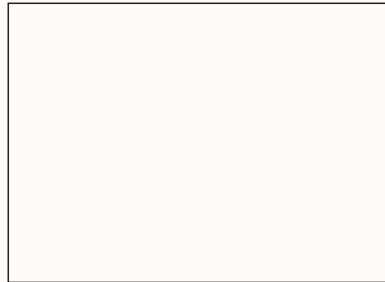
Rock Mulch, Topsoil and Woodchips
(Stable yet high presence of weeds)



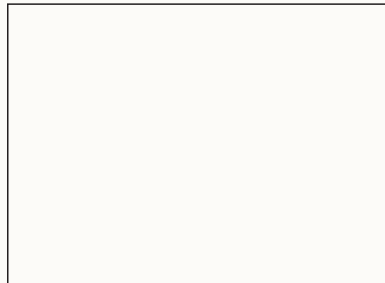
Biosolids 15 t/ha
(Very unstable with active erosion, very limited vegetation)



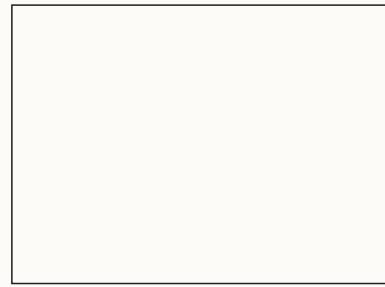
Rock Ribbon
(Susceptible to erosion downslope)



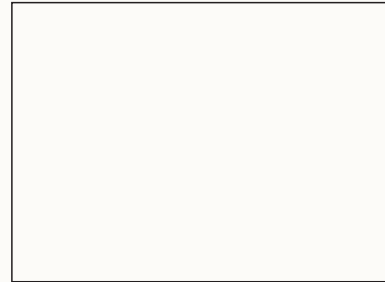
Cross-ripped Rock Mulch and Topsoil
(Stable with higher presence of native grass sp.)



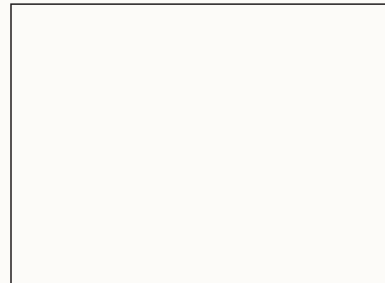
Topsoil and Woodchips
(Unstable, suppressed vegetation growth)



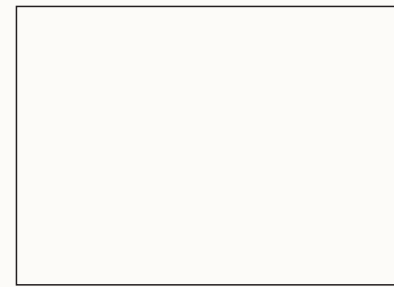
Rock Ribbon and Wheaten Hay
(Sparse vegetation cover)



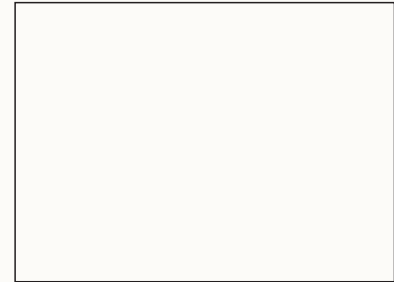
Bioremediation Solids
(Limited surface protection, susceptible to erosion)



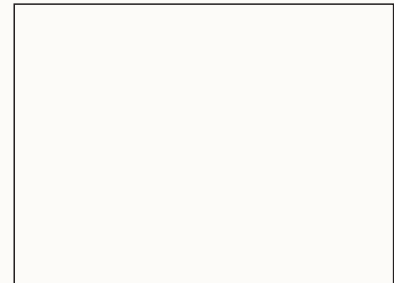
Topsoil and Wheaten Hay
(Sparse vegetation cover, potentially unstable in long-term)



Loose Rock
(Very limited vegetation growth)



Biosolids 45 t/ha
(Dense vegetation cover, dominated by exotic weed sp.)



Topsoil
(Patchy vegetation, potentially unstable in long-term)

Table 1
Summary of Preliminary Results of TSF Trial

Mulch Treatment	Comment on Performance	Likely Suitable for Future Use	Recommendations
Wood mulch/pallets and cardboard	Mulch was applied at a significantly high rate and provided stability but limited initial vegetation establishment.	No	May be suitable if applied at a much lower rate or incorporated within topsoil.
Rock ribbons (approximately 5 m apart)	Provided stability in the vicinity of the rock contours but erosion was often observed between the contours, with limited plant growth.	No	Requires mulching between the rock contours.
Rock ribbons (approximately 5 m apart) and clean wheaten hay	Provided stability in the vicinity of the rock contours and the scattered wheaten hay provided stability and conditions suitable for plant establishment in the inter-row areas.	Yes	Dense mulch layers may suppress native vegetation if applied too densely and thickly.
Rock mulch (approximately 300 mm deep) cross-rippled with topsoil	Good stability and moderate to good establishment of native plants.	Yes	Excellent potential.
Rock mulch (approximately 300 mm deep) cross-rippled with topsoil and woodchips	Good stability but the heavy layer of woodchips limited plant establishment.	No	Reduce rate of woodchips.
Loose rock	Good stability but the heavy layer of rock mulch limited plant establishment.	No	Limited ecological function, at least in the short term.
Site produced bioremediation solids	Unstable and limited plant establishment.	No	May be more successful if used in conjunction with other treatments.
Biosolids 15 t/ha	Unstable with limited plant establishment.	No	Higher application rate required or used in conjunction with other mulch treatments.
Biosolids 45 t/ha	Stable and good plant establishment of cover crop. Limited native plants.	Potential	Requires seeding/planting of native perennial species for long-term sustainability.
Topsoil covered with woodchips	Unstable with limited plant establishment.	No	Higher application rate required or used in conjunction with other mulch treatments.
Topsoil covered with clean wheaten hay	Topsoil alone was not providing a stable substrate, hence the application of hay mulch.	Yes	Dense mulch layers may suppress vegetation if applied too densely and thickly. Initial erosion (hence lost resources) may have reduced the capacity for vegetation to become established. More success may have been achieved if hay was immediately applied.
Topsoil	Variable stability and plant establishment.	No	Requires application of additional mulch treatments. Not suitable for long steep slopes.

After: DnA Environmental (2010)

Since DnA Environmental's preliminary assessment in 2010, monitoring results have confirmed that the most effective surface treatments were the sites including rock mulch covered with topsoil (with and without the clean wheaten hay) that were cross-rippled along the contour of the slope (DnA Environmental, 2014). Monitoring results indicate that sites including cross-rippled rock mulch and topsoil continued to be more stable and functional compared to the other surface treatments and has very similar LFA indices for infiltration and nutrient cycling capacity compared to the grassland reference sites (DnA Environmental, 2014).

Although stability values were lower than reference sites, the stability values have continued to improve over time (DnA Environmental, 2014). Cross ripping along the contour has also been observed to trap sediments and retain soil moisture (DnA Environmental, 2014).

The application of clean wheaten hay improved soil protection and vegetation cover, with rilling and erosion evident in areas where hay was not applied (DnA Environmental, 2014). A rill assessment undertaken at various trial sites demonstrates that any exposed soil can rapidly erode if it does not have a protective cover such as rock mulch, hay and/or vegetation (DnA Environmental, 2014). However, monitoring results also indicate that if clean wheaten hay is applied too densely, vegetation establishment is limited (DnA Environmental, 2014) (Plate 6).

Monitoring results show that native pasture hay improves the diversity of native plants and is likely to provide an ongoing supply of seed and therefore increase the potential for further plant establishment (DnA Environmental, 2014). As a result, DnA Environmental (2014) recommended that if available locally harvested seed bearing native pasture hay be used as the preferred top surface treatment (spread loosely or in rows), instead of clean wheaten hay, to provide a source of local native pasture seeds.

Monitoring results of the trial area including rock mulch, topsoil and woodchips (cross-rippled along the contour of the slope) have also shown that these treatments may provide long-term slope stability, however the surface layer of woodchips has been observed to limit vegetation establishment (DnA Environmental, 2010; 2013a) (Plate 6).

In trial areas that used rock ribbons constructed along the contour of the slope 5 m apart, evidence of rilling, sheet erosion and patches of sediment deposition was often observed between the rock ribbons (DnA Environmental, 2010). On areas where wheaten hay has been applied across the rock ribbon contours, the hay was observed to stabilise the soil (DnA Environmental; 2010; 2013a).

In trial areas including site produced bioremediation solids only, the sites were typically unstable with limited plant establishment (DnA Environmental, 2010). Sites which included high application rates of biosolids were observed to be more stable with high vegetation cover (Plate 6), however the vegetation included limited native plant species and was dominated by exotic weed species (DnA Environmental, 2010; 2013a).

Plates 7 to 10 show the initial performance of rock mulch and topsoil treatments in 2010 (which have been cross-rippled along the contour of the slope) versus other less successful surface treatments including rock ribbons and site produced bioremediation solids.

Based on the results of trials including various surface treatments, a rehabilitation trial area was established on the southern waste rock emplacement to include plots trialling the most promising treatments (i.e. rock mulch, topsoil and woodchips). A description of this trial and the results to date is provided below.

Southern Waste Rock Emplacement

A rehabilitation trial on the southern batter of the southern waste rock emplacement commenced in September 2009. The objective of the trial was to compare the effectiveness of surface treatments (including rock mulch, topsoil and wood chips, with or without a subsoil layer, placed on the oxide waste rock substrate) and different slope designs (i.e. single long slope 1 vertical [V]:5 horizontal [H] compared to a three tiered battered slope 1V:3H). Approximately 10 t/ha of gypsum was ripped into the waste rock layer prior to subsoil placement. Plate 11 shows the southern waste rock emplacement trial area in 2010 (six months after establishment of the trial).



Plate 7: Rock Mulch and Topsoil Cross-rippled along the Contour
(Stable, with high presence of native grass sp.) (2010)



Plate 9: Rock Ribbon
(Active erosion downslope and sparse vegetation cover)



Plate 8: Rock Mulch, Topsoil and Native Pasture Hay
(Stable, consistent soil surface cover and high presence of native grass sp.) (2010)

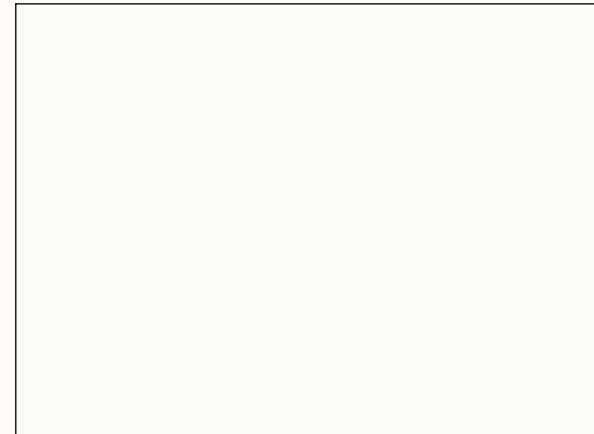


Plate 10: Bioremediation Solids
(Limited surface protection resulting in active erosion)

The surface treatments trialled for both slope designs included (DnA Environmental, 2013a):

- topsoil (with and without a subsoil layer);
- rock mulch (300 mm deep) (with and without a subsoil layer);
- rock mulch (300 mm deep) covered with topsoil (with and without a subsoil layer);
- rock mulch (300 mm deep) covered with topsoil and woodchips (with and without a subsoil layer);
- rock mulch (300 mm deep) covered with woodchips (with and without a subsoil layer); and
- a control (i.e. no treatment).

Annual monitoring and evaluation of this trial area was undertaken between 2009 and 2014. In 2012 and 2013 monitoring focussed on the trial plots which demonstrated better ecological performance. These plots included those with a topsoil treatment (i.e. rock mulch and topsoil, and topsoil only). DnA Environmental's (2015) conclusions from the results of the rehabilitation trial include:

- Overall, it appears that treatments with rock and topsoil and topsoil only reached more numerous ecological targets compared to the other trial treatments.
- Under the conditions of this trial, these two treatments were very similar in the parameters that were measured, but there may be additional benefits in using the underlying rock mulch to provide additional stability in the case of extreme climatic events (e.g. high rainfall and drought) especially before the vegetation had become established.
- This trial has also confirmed that it is imperative that a protective soil cover treatment be applied, regardless of its type or combination.
- Better longer term ecological outcomes and achievement of completion targets may be obtained when there is good plant establishment, especially that of the native perennial vegetation. The treatments compared in these trials have shown that this can be achieved using topsoil, with or without a rock mulch underlay, but initial erosion control measures such as the light-medium application of native pasture hay or other mulch treatments in rows along the contour and/or shallow ripping along the contour may be required to provide immediate soil protective cover and additional erosion control features.
- In order to reach completion targets associated with woodlands occurring on ridges and hills, there will be a requirement to ensure an appropriate diversity and density of trees and shrubs are incorporated into the planning and implementation of future rehabilitation areas.

Plates 12 and 13 show photos of the performance of the various treatments on the southern waste rock emplacement trial area in October 2012 and September 2016, respectively.

Northern Waste Rock Emplacement

In accordance with a recommendation provided by the CGO's Independent Monitoring Panel, a rehabilitation trial area has been established on the northern slopes of the northern waste rock emplacement including various applications of the most successful cover treatment from the TSF trials and southern waste rock emplacement trial (i.e. rock mulch, topsoil and hay).

The northern waste rock emplacement trial area includes plots trialling different topsoil depths and different hay mulch types (i.e. seed bearing native pasture hay versus clean wheaten straw hay or no hay treatment) and the effects of these differing treatments on the performance of native tubestock plantings including *Eucalyptus*, *Acacia* and *Dodonaea* species.

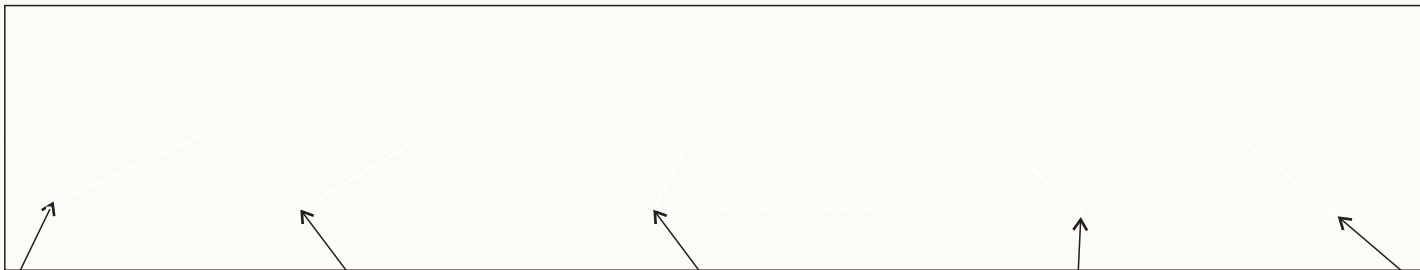
Plate 11: February 2010



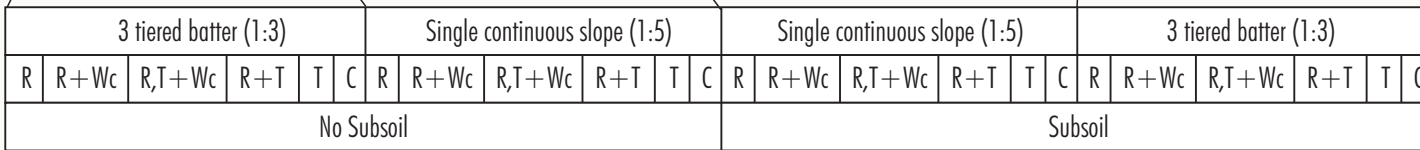
Plate 12: October 2012



Plate 13: September 2016



Trial Area



Southern Waste Rock Emplacement Trial Design

Legend	
(R)	Rock mulch
(R+Wc)	Rock mulch + woodchips
(R+T+Wc)	Rock + topsoil + woodchips
(R+T)	Rock + topsoil
(T)	Topsoil
(C)	Control or No treatment

Due to various issues associated with establishment of the trial, the trial area has been split into two areas, the '2012/2013 trial area' and the '2014 trial area'. Due to a delay in harvesting of local native pasture hay, the 2012/2013 trial area does not include an application of native pasture hay. In addition, given seasonal conditions were not suitable for tubestock planting at the time of establishment of the 2012/2013 trial area, no tubestock planting occurred in 2012/2013.

The 2012/2013 trial area comprises plots with a base layer of rock mulch (approximately 300 mm deep) ripped along the contour of the slope and includes the following treatments (DnA Environmental, 2016a):

- Three topsoil depths (with approximately 10 t/ha gypsum spread after topsoil placement):
 - 150 mm;
 - 200 mm; and
 - 300 mm.
- Two hay mulch treatments:
 - clean wheaten straw hay spread in clumps approximately 1.5 m apart; and
 - no hay mulch treatment.

The 2014 trial area also comprises plots with a base layer of rock mulch (approximately 300 mm deep) ripped along the contour of the slope, however includes the following treatments (DnA Environmental, 2016a):

- Three topsoil depths (with approximately 10 t/ha gypsum spread after topsoil placement):
 - 150 mm;
 - 200 mm; and
 - 300 mm.
- Three hay mulch treatments:
 - seed bearing native pasture hay;
 - clean wheaten straw hay; and
 - no hay mulch treatment.

The underlying waste rock substrate of the northern waste rock emplacement trial area includes oxide waste rock.

Tubestock were planted across the 2012/2013 trial area and 2014 trial area in August 2014 at a planting rate of thirty plants per 20 m x 20 m trial plot. The tubestock included the following native species:

- 3 x *Eucalyptus microcarpa* (Grey Gum);
- 3 x *Eucalyptus dwyeri* (Dwyer's Red Gum);
- 6 x *Acacia decora* (Western Golden Wattle);
- 6 x *Acacia deanei* (Green Wattle);
- 6 x *Acacia hakeoides* (Hakea Wattle); and
- 6 x *Dodonaea viscosa subsp. cuneata* (Wedge-leaf Hopbush).

The species above were selected by DnA Environmental based on their list of woodland tree, shrub, and sub-shrub species considered suitable for use as tubestock on the CGO's waste rock emplacements (Section 2.4.4). These species are considered by DnA Environmental (2016a) to be associated with woodlands on low ridges, hills and elevated land in the Lake Cowal area and likely to be compatible with the proposed final land use for the CGO waste rock emplacements.

Due to hot weather and varied planting techniques/positions (i.e. planting on the bank of the contour not in the trough), an approximate 25 percent (%) mortality rate was recorded by November 2014 with affected tubestock removed and replanted in May 2015.

Figure 6 shows a conceptual view of the design of the northern waste rock emplacement trial. Plates 14 to 18 show recent photos of the rehabilitation trial area.

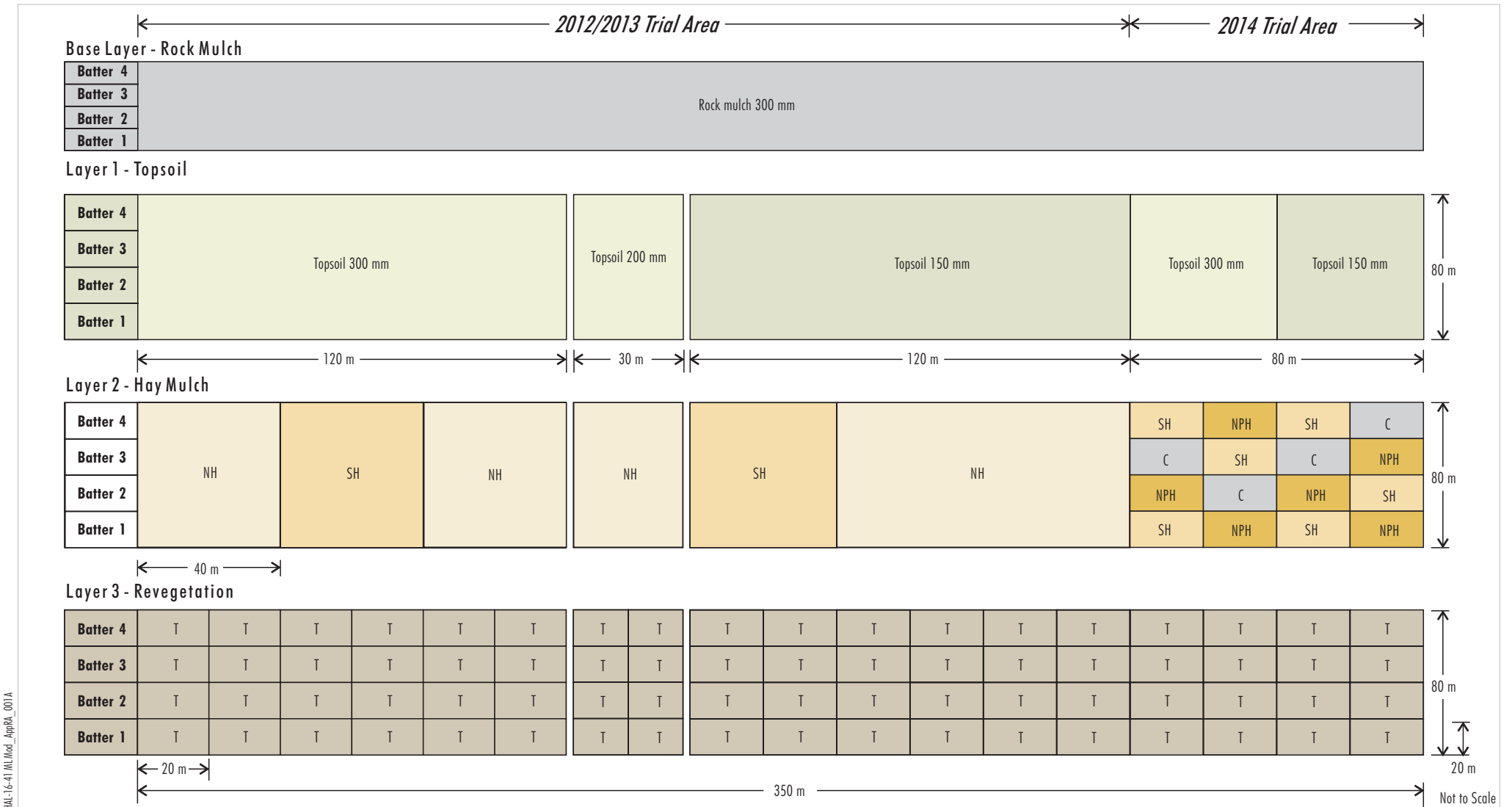
A monitoring programme has been developed for the trial and is consistent with the monitoring methodology used for other CGO rehabilitation areas (Section 3.6). A range of ecological indicators (based on monitoring data from reference sites relevant to the CGO's waste rock emplacements) will be used to assess the performance of the trial (Section 3.6).

Preliminary monitoring results from the northern waste rock emplacement trial indicate (DnA Environmental, 2016a):

- Dead leaf litter (typically *Lolium rigidum* [Wimmera Ryegrass]), straw and native pasture hay mulches were in slight to moderate states of decomposition resulting in an increasingly organic and more stable topsoil profile in the majority of sites (Plates 17 and 18).
- *Lolium rigidum* (Wimmera Ryegrass), an annual exotic grass which has established from the topsoil seed bank, was present in high abundance across the trial areas (Plate 15).
- The data indicates that tubestock survival may have been increased within nil mulch treatments (i.e. in sites with no straw hay or native pasture hay treatments), especially in the 2014 trial areas where no tubestock mortalities were recorded regardless of topsoil depth.
- The majority of tubestock were 0.5 – 1.0 m in height, but many also exceeded 1.0 m in height, with a few in the 2012/2013 trial area, greater than 2.0 m.
- Results of some soil tests have indicated excessively high levels of sulphur, especially in the 2014 trial area, which may have implications for the development of these areas. Notwithstanding DnA Environmental's finding, the CGO's Independent Monitoring Panel indicated during their October 2016 site inspection that these high levels of sulphur are unlikely to affect plant growth/health.
- Presently there was no obvious effect of the trial treatments (or substrate material) upon the growth rates of the tubestock.
- Most trial treatments (even plots without mulch treatments) contained acceptable levels of total ground cover with some sites having 100% total ground cover.
- Although the lowest ground covers were recorded in the plots with nil treatments, these sites tended to have a greater proportion of cover provided by native annual plants.

DnA Environmental (2016a) notes the following key conclusions from the preliminary monitoring results from the northern waste rock emplacement trial:

- While the extensive voluntary establishment of *Lolium rigidum* (Wimmera Ryegrass) from the soil seed bank has provided significant ecological stability and function of some of the rehabilitation areas, the high competition effects on planted tubestock and other desirable native ground covers remains unknown at this stage.



HAL-6-41-MLMod_AppRA_001A

After: DnA Environmental (2016)

LEGEND

- T Tubestock including Eucalyptus Acacia and Dodonea species
- NPH Native Pasture Hay
- SH Straw Hay
- NH No Hay
- C Control

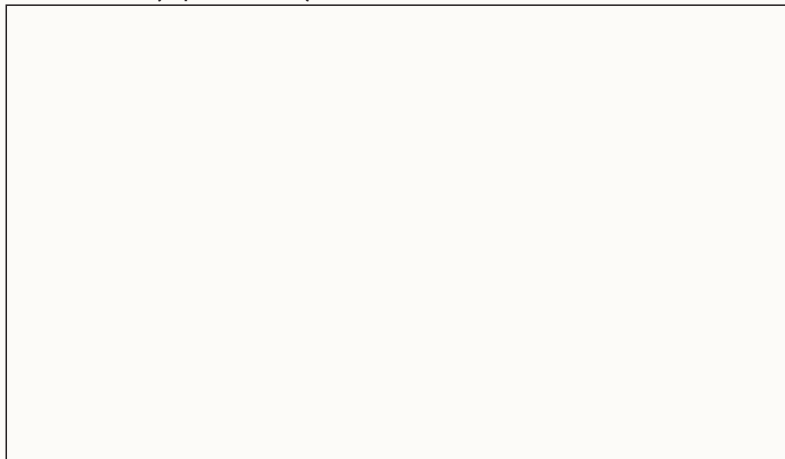
CGO MINE LIFE MODIFICATION

Northern Waste Rock Placement Rehabilitation Trial Design

Figure 6



**Plate 14: Northern Waste Rock Emplacement trial area (looking south-west)
(September 2016)**



**Plate 15: Northern Waste Rock Emplacement trial tubestock growth
(approximately two years old) and dense *Lolium Rigidum*
(Wimmera Ryegrass) ground cover.**

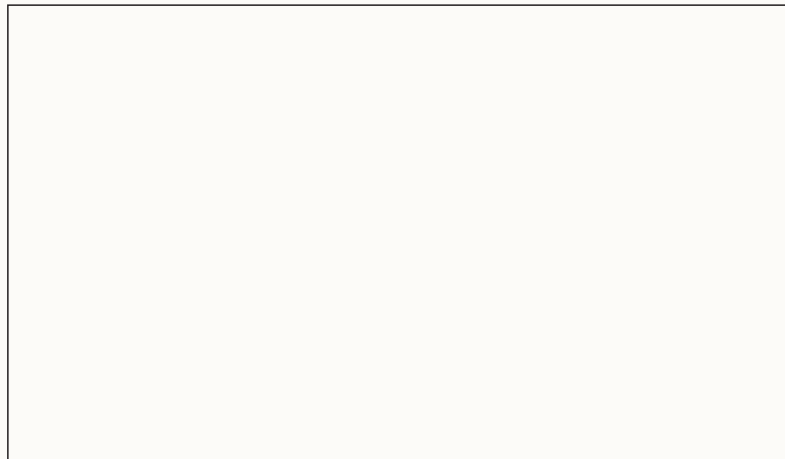


Plate 16: Tubestock growth in 150mm topsoil.

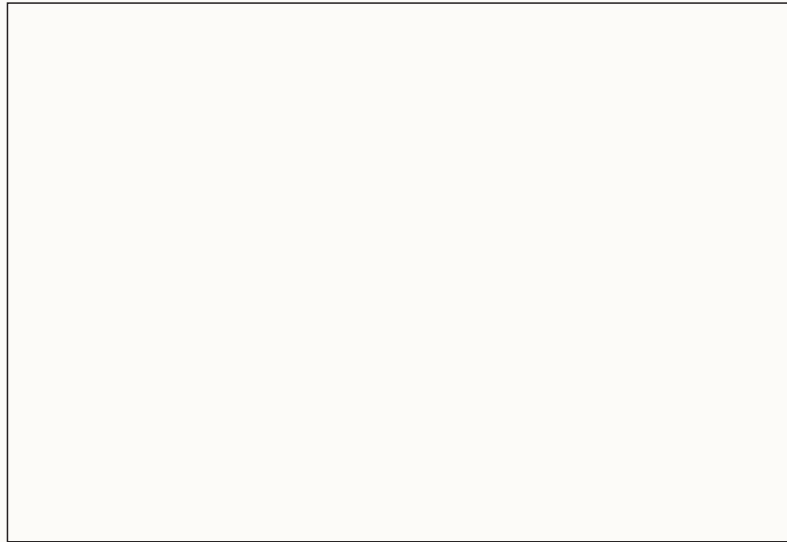


Plate 17: Organic topsoil profile provided by dead leaf litter and mulch decomposition.

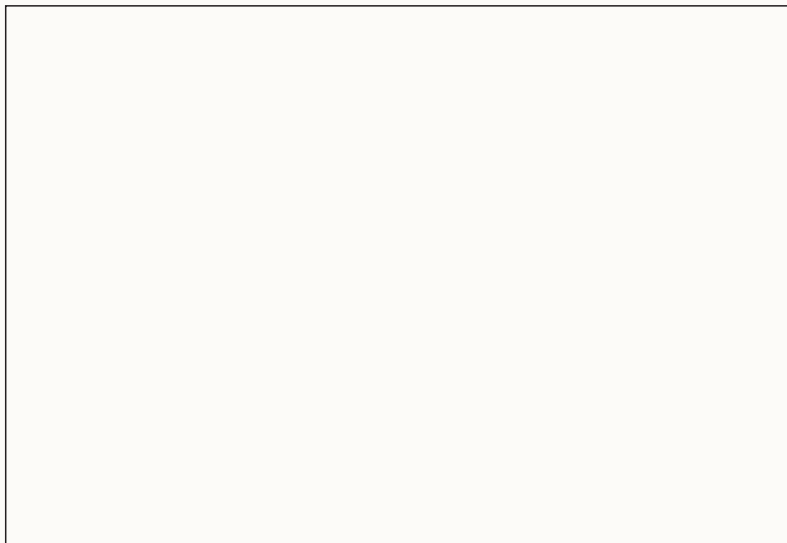


Plate 18: Extensive fungal hyphae contributing to litter decomposition and nutrient cycling processes.

- Management intervention to reduce competition effects by *Lolium rigidum* (Wimmera Ryegrass) may be required in the early establishment phase so that native trees, shrubs and ground cover similar to the local hill and ridges can become well established.
- Successful establishment of woodlands from seed is a preferred option to tubestock planting over the increasingly large rehabilitation areas.
- The survival and growth rates of the tubestock are likely to be implicated with a range of other variables, making it difficult to determine if the trial treatments including different topsoil depths and mulching types are having an influence on the development of the sites at this stage. Some other variables affecting tubestock survival may include:
 - planting time and coincidence with optimum rainfall event (differences between year of trials);
 - planting position (i.e. planting of tubestock in trough of contour versus the bank of the contour);
 - planting techniques (differences between planting personnel);
 - competition from other ground covers (especially *Lolium rigidum* [Wimmera Ryegrass] during spring when it is actively growing and moisture becomes limiting);
 - variability in watering regimes (different techniques between personnel or areas of the trial);
 - effectiveness of supplementary watering (frequency, volume, infiltration, erosion around roots, etc); and
 - soil chemistry (associated with the different soil stocks used across the trial area [poor soil chemistry observed in the 200 mm topsoil area]).
- Presently there is no clear indication that the depth of topsoil affects the diversity of species, but the heavy application of straw and native pasture hay mulches is likely to have reduced floristic diversity as it was applied too thickly.
- While there were some anomalies in soil characteristics, it appears too early to tell which depth of topsoil and mulch application is more conducive to producing a functional and diverse woodland community which is representative of the hills and ridges of the Lake Cowal area. This is likely to become more apparent with the growth and development of the planted trees and shrubs which will have a significant influence on the composition of the sites especially when they become mature and provide an overstorey canopy.

In response to the preliminary findings of the northern waste rock emplacement trial, Evolution proposes to investigate the most effective methods for direct seeding rehabilitation areas following the establishment of the initial Wimmera Ryegrass cover crop (Section 3.4).

In addition, and notwithstanding the Independent Monitoring Panel's assumption, soil testing will continue to be undertaken across the trial areas to investigate the high levels of sulphur observed from some soil tests, and an assessment of plant growth/health in these areas will be undertaken during the 2016 monitoring round. Further, a plant root growth assessment will also be undertaken on various tubestock planted in the northern waste rock emplacement trial area to assess root development through the oxide substrate and surface rehabilitation materials.

Geochemical Assessment of Rock Armouring Material

A *Rock Armour Suitability Geochemical Assessment for the Cowal Gold Mine* was conducted by Geo-Environmental Management Pty Ltd (GEM) in 2008 to assess the suitability of the CGO's oxide and primary waste rock for use as rock armouring on CGO landform slopes.

The main findings of the assessment indicated (GEM, 2008):

- The oxidised waste rock typically contains low sulphur and low acid neutralising capacity (ANC) and in terms of acid generation these materials are likely to be benign. However, a large proportion of the oxidised waste (70 %) is likely to be saline.
- All of the primary waste rock types are typically non-saline.
- The primary waste rock contains reactive sulphides, however, due to their moderate to high ANC, all of the primary waste rock types are expected to be non-acid forming (NAF).

The majority of the waste rock samples assayed were found to be enriched in arsenic and some of the samples were found to be enriched in cadmium, lead, antimony and zinc. However, water extract testing showed that under the prevailing near-neutral pH condition these elements are not soluble and provided these pH conditions are maintained element solubility and release from these materials is not expected to be a concern.

Based on these findings the following recommendations were made (GEM, 2008):

- Due to the expected salinity and sodicity of the oxidised waste rock, this material is not suitable for armouring the batter slopes of the waste rock emplacements and TSFs.
- The primary waste rock is typically non-saline and NAF and the majority of this material is expected to be suitable rock armour material. However, materials with higher reactive sulphide contents (greater than 0.5% sulphur) are likely to present a risk of developing saline conditions when oxidised and these materials should either be excluded from use as rock armour or blended with the lower sulphur material in order to dilute the reactive sulphides.

GEM (2008; 2013) recommended either of the following quality control programmes be implemented to either exclude high sulphur material or to blend the high sulphur material with the lower sulphur material in order to dilute the reactive sulphides:

- As materials with reactive sulphur contents greater than 0.5% sulphur would contain significant visible sulphide, and therefore would be identifiable in the field, a quality control programme which involves training site personnel to identify materials with visible sulphide could be implemented to exclude these materials.
- Alternatively, if materials with higher reactive sulphide contents are blended with the lower sulphur material to dilute the reactive sulphides, a quality control programme should be implemented which involves collecting samples of the blended waste rock for geochemical testing prior to use as rock armouring to confirm the waste rock has been adequately blended. GEM (2008; 2013) has also recommended that should the CGO blend the primary waste rock, the site water quality monitoring programme should include the parameters arsenic, cadmium, lead, antimony and zinc (if not included already) given these elements have been found to be significantly enriched in some of the primary waste types.

The geochemistry assessment for the Modification (GEM, 2016) (Appendix C of the *CGO Mine Life Modification Environmental Assessment*) concluded that the waste rock from the current pit and Modification area are geochemically comparable, indicating that the management strategies currently employed for the waste rock emplacements would not need to be modified.

As a result of the geochemical assessments of waste rock conducted to date (GEM, 2008; 2009; 2013; 2016) the following management strategies are conducted at the CGO:

- testing of primary waste rock material is undertaken to assess sulphur content and only benign primary waste rock is used as rock armouring for mine landform slopes; and

- due to the saline and highly sodic nature of oxide waste rock, a layer of primary waste rock will be placed over the top surface (and batters) of the southern waste rock emplacement which has largely been constructed of oxide waste rock material.

2.4.2 Water Management and Erosion Control on Landform Slopes

A Review of Rehabilitation and Water Management Concepts for the Mine Waste Rock Dumps and Lake Isolation Bund at the Cowal Gold Project was conducted by Gilbert and Associates (2009) to assess surface water runoff rates and flow velocities under various rainfall events on slopes of the northern and southern waste rock emplacements and on the temporary isolation bund. The slopes assessed included single long slopes and slopes with berms including topsoil and sparse vegetation cover or with a rockfill (i.e. rock mulch) surface treatment. Key findings of the assessment included (Gilbert and Associates, 2009):

- Estimated flow velocities are relatively low under sheet flow conditions (i.e. slopes with topsoil only and sparse vegetation). However sheet flow does not naturally prevail on steep batter slopes.
- A layer of rockfill placed over the erodible oxide waste material would provide the dual benefits of greater resistance to erosion and reduced flow velocities.
- Depending on the nature of the rockfill, flow velocities under Probable Maximum Precipitation event and a 1 in 100 year average recurrence interval event are likely to be low enough to provide longer term stability.
- A critical issue for the rockfill option would also be the erosional stability of the contact material (i.e. the underlying oxide waste rock layer) and the potential for undercutting of the rockfill layer.
- Limits on sizing and thickness of the rockfill will need to be established to minimise the potential for erosion occurring downslope from large rocks. Results of rehabilitation trials should be used to inform appropriate specifications for rockfill layer thickness and limits of rock sizes.

As a result of the findings of Gilbert and Associates (2009) assessment, the size of rocks used in rock armouring of landform slopes is limited to less than approximately 400 mm to minimise the potential for erosion occurring downslope from large rocks. The sizes of rocks used in the rock mulch layer for the northern waste rock emplacement trial (Section 2.4.1) have been limited to less than approximately 300 mm.

Results from rehabilitation trials conducted to date including the northern waste rock emplacement trial indicate that a 300 mm deep layer of rock mulch has successfully stabilised outer batter slopes of the waste rock emplacements and TSFs.

The monitoring methodology for the northern waste rock emplacement trial includes measuring the presence of erosion (including active gullying and/or rills) to determine the effectiveness of the rock mulch layer in stabilising the landform slope. Monitoring results have demonstrated that cross-ripping the rock mulch and topsoil along the contour of the slope plus a protective mulch or annual grass cover has provided effective erosion control on the landform slope.

2.4.3 Material Characterisation and Amelioration

Initial characterisation and analysis of the CGO's stockpiled soil resources commenced in 2010. The project included preliminary assessment of samples of CGO waste rock, subsoil and topsoil materials to determine gypsum application rates likely to reduce sodicity of the soil resources sampled. The assessment indicated that an average of 10 to 15 t/ha gypsum was likely required to improve CGO waste rock/soil characteristics (Drake, 2012).

A comprehensive sampling programme of the CGO's stockpiled topsoil and subsoil resources commenced in 2012 to characterise the available soil resources, assess their suitability for rehabilitation use and to determine the most effective amelioration or treatment measures required to improve the soil for rehabilitation use.

Evolution engaged Dr David McKenzie (a leading certified professional soil scientist in NSW) of McKenzie Soil Management Pty Ltd to interpret the results from the sampling programme, assess the suitability of the soils for rehabilitation use and provide recommendations for amelioration of the soil.

A summary of the soil characterisation assessment results from McKenzie Soil Management's (2013) *Cowal Gold Mine Soil Stockpile Characterisation Assessment* report is provided below.

Soil Stockpile Sampling Programme

The field survey and sampling of the CGO soil stockpiles was undertaken in February and March 2012. Thirty-seven test pits were excavated using a backhoe (Plates 19 and 20) across 16 topsoil and three subsoil stockpiles located within ML 1535. Some subsoil and topsoil stockpiles were unable to be accessed due to safety concerns or due to operational constraints at the time of sampling. These stockpiles included Topsoil 04, Subsoil 01, Subsoil 04, Subsoil 05 and Subsoil 06. It should be noted that as a result of operations since March 2012 (when sampling of the soil stockpiles commenced), some soil stocks have been moved and/or used on rehabilitation areas. The indicative locations of topsoil and subsoil stockpiles at the CGO (as at October 2016) are shown on Figure 7.

The test pits were excavated to the depth of the soil stockpile (up to approximately 4 m) with soil samples taken at regular intervals and observations of the soil profile characteristics recorded. Soil samples were collected for soil chemical analysis and Aggregate Stability in Water dispersion testing.

Based on the field observations of the soil profiles of the stockpiles and the laboratory results, the physical and chemical characteristics of the soil samples from each soil stockpile were identified. McKenzie Soil Management subsequently assessed the suitability of the topsoil and subsoil resources for plant growth and identified average gypsum requirements for each soil stockpile. A summary of the topsoil and subsoil characteristics, the likely suitability of the soil for plant growth and McKenzie Soil Management's recommendations for improving the soil for rehabilitation use is provided below.

Topsoil

The majority of stockpiled topsoil resources at the CGO reflect the hard pedal red duplex soils associated with the majority of the ML 1535 area. The soils have a fine sandy clay loam to medium heavy clay loam texture and are hard setting (McKenzie Soil Management, 2013). These soils are dispersive (where non-saline), have variable pH, are partially phosphorus deficient, range from non-saline to strongly saline and are sodic (McKenzie Soil Management, 2013). Compaction was also observed in numerous topsoil stockpiles.

Some small patches of topsoil stocks (within Topsoil Stockpiles 02 and 06) (Figure 7), however, are strongly saline in the upper profile and are therefore recommended to be discarded. In addition, some topsoil stocks show physical and chemical characteristics typical of subsoil and have been recommended for inclusion with subsoil stocks to be treated with gypsum (i.e. Topsoil Stockpile 19 and Topsoil Stockpile 10) (Figure 7) (McKenzie Soil Management, 2013).

To enhance the suitability of topsoil stocks for plant growth, gypsum application rates ranging between 0 and approximately 35 tonnes per hectare per metre (t/ha/m) have been recommended by McKenzie Soil Management (2013), except for Topsoil Stockpile 19 and Topsoil Stockpile 10 which have been recommended for inclusion with subsoil stocks. These stocks have been assessed by McKenzie Soil Management (2013) as requiring approximately 74 and 73 t/ha/m gypsum, respectively.

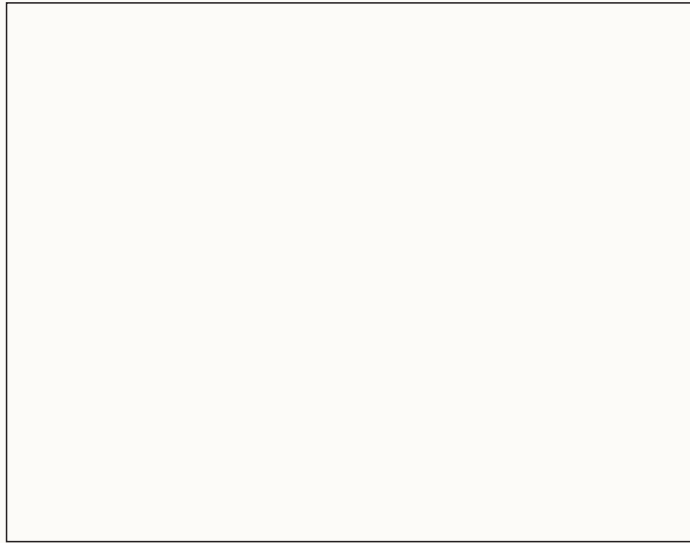


Plate 19: Soil Test Pit Excavation of Topsoil Stockpile 02 (March 2012).

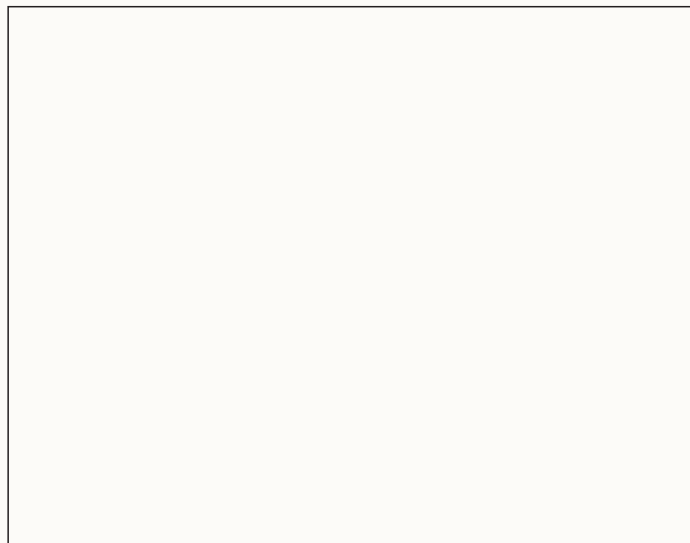
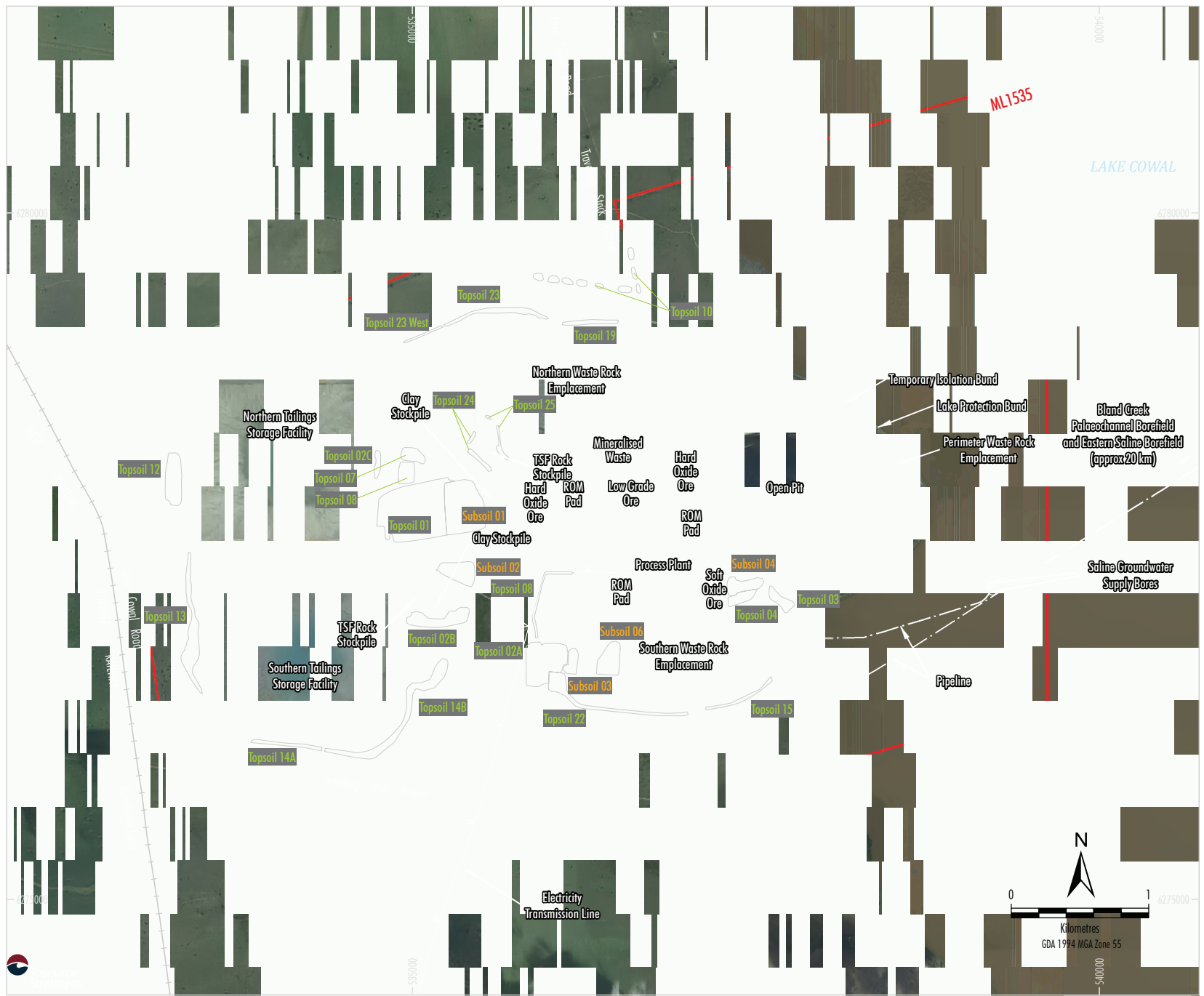


Plate 20: Soil Test Pit Sampling (March 2012).



- LEGEND**
- Mining Lease Boundary (ML 1535)
 - Topsoil Stockpile
 - Subsoil Stockpile

Source: Evolution - Orthophoto (August 2016)

CGO MINE LIFE MODIFICATION
 Indicative Location of Soil Stockpiles -
 October 2016

Figure 7

Subsoil

The majority of stockpiled subsoil resources also reflect the hard pedal red duplex soils associated with the majority of the ML 1535 area. The soils have a light medium clay texture and are extremely hard when dry (McKenzie Soil Management, 2013). The subsoil stocks are dispersive, strongly saline, strongly sodic, phosphorus deficient and have variable pH ranging from neutral to alkaline (McKenzie Soil Management, 2013). Compaction was also observed in some areas of Subsoil Stockpile 02 (Figure 7) (McKenzie Soil Management, 2013).

To enhance the suitability of subsoil stocks for plant growth, gypsum application rates ranging between approximately 91 and 153 t/ha/m have been recommended by McKenzie Soil Management (2013).

Plates 21 to 24 show examples of various soil profiles of both topsoil and subsoil stockpiles. Photographs of the soil profile of each soil test pit assessed in the soil stockpile sampling programme are provided in Appendix D of McKenzie Soil Management's (2013) report.

Soil Amelioration

Various methods have been proposed by McKenzie Soil Management to apply the gypsum (or lime) to existing soil stocks or to soil stripped from Modification disturbance areas. These methods include (McKenzie Soil Management, 2013):

- deep-ripping and applying gypsum (or lime) to existing and proposed soil stockpiles;
- placing and treating strongly sodic and dispersive soil stocks with gypsum in a dedicated soil amelioration farm;
- applying gypsum to soil during re-application on rehabilitation areas; and
- applying gypsum to the original soil surface prior to stripping.

Dr McKenzie also advised the CGO Environmental Department staff that due to the sodic and dispersive nature of the oxide waste rock material, gypsum should be spread on the surface of oxide waste rock material (i.e. in particular on the southern waste rock emplacement) prior to the application of the rehabilitation cover materials (e.g. rock mulch and gypsum-treated topsoil).

A description of proposed soil management and soil amelioration measures for the Modification is provided in Section 3.5.2.

2.4.4 Revegetation

New Lake Foreshore and Lake Protection Bund

A rehabilitation trial on the New Lake Foreshore and lake protection bund commenced in 2005. The trial focused on re-establishing various aspects of the native vegetation communities dominating the lake foreshores and targeted (DnA Environmental, 2013a):

- ground cover and ground cover species;
- establishing wetland species and local tree and shrubs species; and
- provision of habitat features.

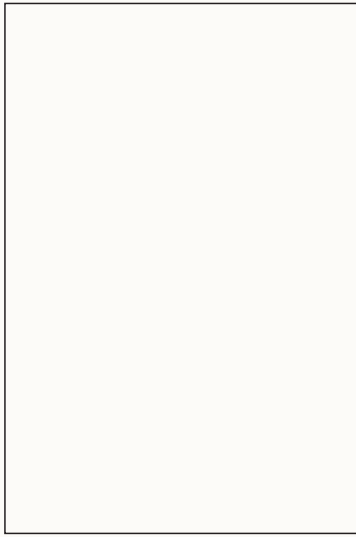


Plate 21: Topsoil Requiring Approximately 10 t/ha Gypsum

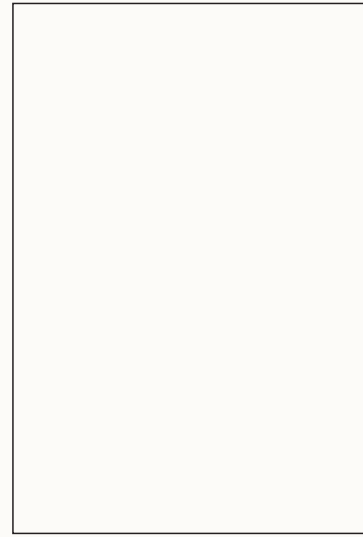


Plate 22: Topsoil (including Central Compacted Layer) Requiring Approximately 16 t/ha Gypsum

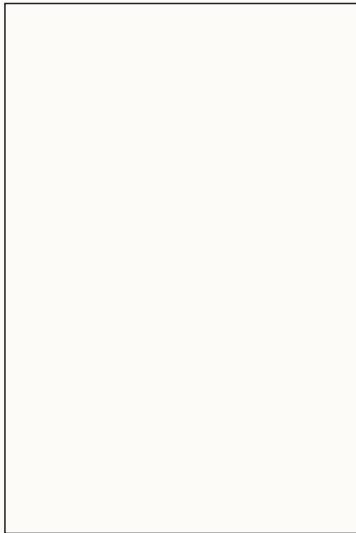


Plate 23: Subsoil (with Surface Clay Layer) Requiring Approximately 21 t/ha Gypsum



Plate 24: Topsoil (showing characteristics of Subsoil) Requiring Approximately 53 t/ha Gypsum

The revegetation techniques trialled included (DnA Environmental, 2013a):

- hand-broadcasting locally collected native grass seed (including Speargrass [*Austrostipa nodosa*] seed collected from the mine site in 2005) on grass trial plots at a rate of 10 kilograms per hectare;
- hand broadcasting and direct seeding locally collected River Red Gum (*Eucalyptus camaldulensis*);
- planting of wetland species such as Lignum (*Muehlenbeckia florulenta*) and Rushes from both cuttings and tubestock;
- planting of tree and shrub tubestock; and
- placement of logs and hay mulch and the application of gypsum at 5 t/ha.

To date, rehabilitation monitoring results at permanent monitoring quadrat sites CWT2, CWT3 and CWT6 (refer Figure 14 in Section 3.6) at the New Lake Foreshore indicate (DnA Environmental, 2013a; 2016b):

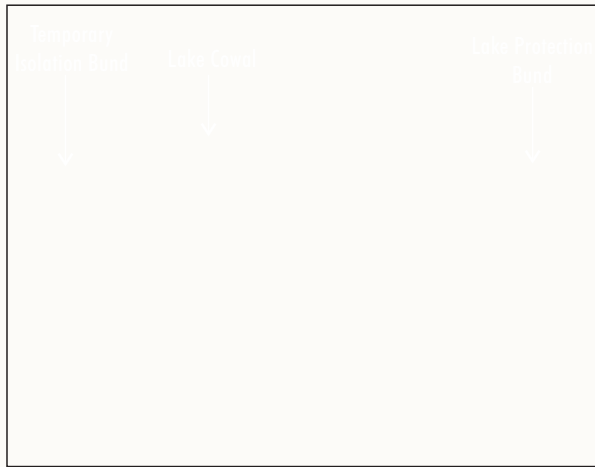
- The spreading out of the habitat logs and branches directly onto unconditioned soil substrates has not been conducive to site stabilisation (unless good soil contact is made).
- The direct application of seed without additional soil conditioning or mulch treatments is not viable (i.e. surface treatment [e.g. rock mulch and topsoil] is required).
- Since 2005 there has been a significant increase in ecological function in the lake foreshore rehabilitation sites largely due to the increase in ground cover from plants which have established as a result of natural regeneration from the topsoil stored seed bank as well as seed applied by hand broadcasting.
- The inundation of Lake Cowal in 2010 to 2014 resulted in a significant increase in floristic diversity.
- Since 2013, the two rehabilitated lake foreshore sites were ecologically functional and comparative to their reference sites and contained an appropriate composition of species.
- Despite the absence of a mature tree overstorey the New Lake Foreshore rehabilitation sites also had a highly functional grassy ground cover layer and these had become particularly stable, especially in CWT3.
- Native species have remained more diverse than exotic species in all sites in all monitoring years.
- The *Muehlenbeckia florulenta* (Lignum) suckers have continued to proliferate and the flood waters have dispersed seed of *Eucalyptus camaldulensis* (River Red Gum), *Acacia stenophylla* (River Cooba) and *Glycyrrhiza acanthocarpa* (Native Liquorice) with a high number of individuals establishing along the high water level.
- There is a declining trend in electrical conductivity (EC) levels since 2010 which is encouraging and is considered to have occurred via natural oxidation and leaching processes.
- The soils continue to be moderately alkaline and sodic, and EC levels remained within desirable levels and the soils can be classed as non-saline in 2015.
- Overall there have been significant changes occurring on the New Lake Foreshore area since 2005. The sites have been progressing and are beginning to stabilise despite the extreme climatic conditions.

Plate 25 shows photographs of monitoring sites CWT2 and CWT3 within the New Lake Foreshore trial area in October 2015.

Site CWT2

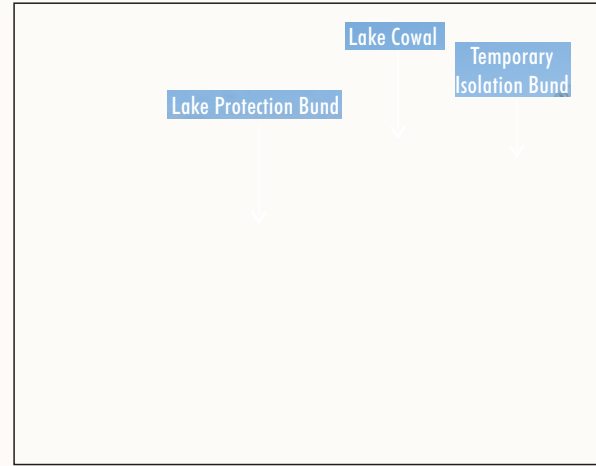


Looking North

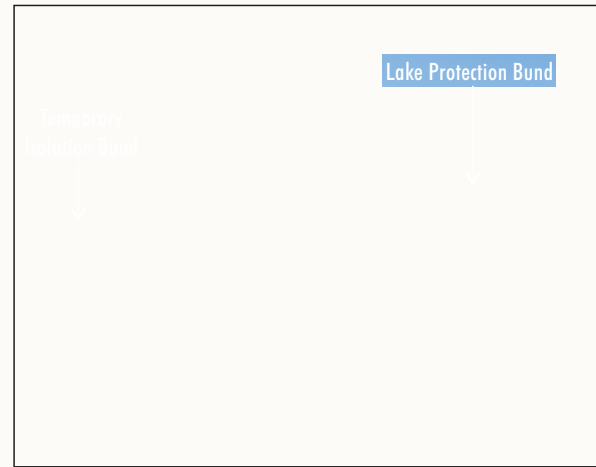


Looking South

Site CWT3



Looking North



Looking South

As a result of the inundation of Lake Cowal in 2010 to 2014, wave action has eroded sections of the New Lake Foreshore, including monitoring site CWT6, resulting in localised instability and loss of vegetation cover. Remedial measures were undertaken on the first upslope batter of the lake protection bund during 2012 which included the application of rock mulch to armour the slope against further lake level rise.

Section 3.3.7 provides a description of the rehabilitation activities proposed for the New Lake Foreshore area, including remedial works for the temporary isolation bund.

Vegetation Growth Trials

A vegetation growth trial was commenced in June 2010 to assess the growth of select salt tolerant deep-rooted native tree species in substrate materials including CGO oxide and sulphide saline tailings material. A control plot (topsoil only) was established for comparison purposes. The growth trial was conducted over a six month period. The objective of the trial was to determine tree species suitable for revegetation of the top surfaces of the CGO TSFs (Barrick, 2013b).

The deep-rooted native tree species trialled included (Barrick, 2013b):

- Grey Box;
- Bimble Box or Poplar Box; and
- Belah (*Casuarina cristata*).

The trial involved planting three seedlings of each tree species in each substrate type (oxide tailings, sulphide tailings and topsoil) within a clear acrylic growth tube approximately 1.2 m in length (Barrick, 2013b) (Plates 26 and 27).

The growth media in each tube included approximately (Barrick, 2013b):

- 870 mm of saline substrate material (i.e. oxide tailings, sulphide tailings or topsoil);
- 50 mm of local red loam topsoil; and
- 125 mm of potting mixture (i.e. the medium in which each tree seedling was grown).

Visual observations throughout the trial indicated that the stems and leaves of the plants showed no visual signs of toxicity or poor health, except for one Bimble Box seedling planted in oxide tailings and one Belah seedling planted in topsoil (i.e. a control plant) which showed signs of dieback (i.e. leaves falling off) (Barrick, 2013b). However, approximately two months later these plants were found to have new growth or continued to grow (Barrick, 2013b).

Visual observations of the root systems of all tree species grown in both tailings substrate types showed some discoloration of the roots (Plates 28 to 30), however all plant root systems grew beyond the end of the growth tube by the six month trial period (Barrick, 2013b). Monitoring results of the root depth of the plants at each monitoring round indicated that there was little difference in root growth rate of the trees planted in oxide tailings material compared with the control (i.e. trees grown in topsoil only) (Barrick, 2013b). Plants grown in sulphide tailings were generally observed to have a shallower root depth than the plants grown in oxide tailings and topsoil, however by the end of the six month trial the root systems of the plants in sulphide tailings continued to grow through the end of the growth tubes (Barrick, 2013b).

The vegetation growth trial results indicate that the selected tree species grew successfully when planted in a substrate including very limited topsoil and initial potting mix growth medium (i.e. 5 centimetres [cm] of topsoil and 12.5 cm of potting mix) and saline tailings material.

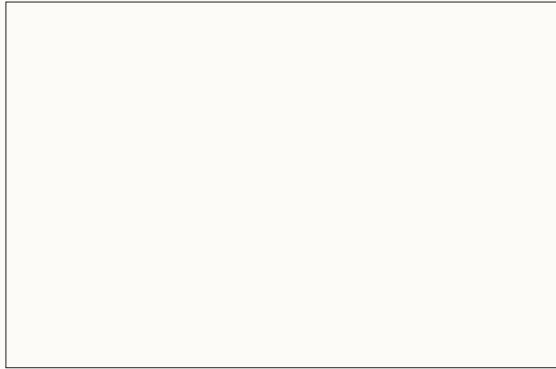


Plate 26: Vegetation Growth Trial Design

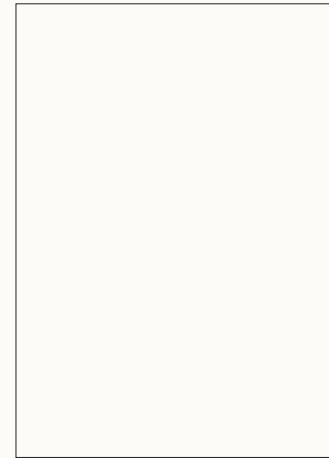


Plate 27: Substrate Materials including Potting Mix,
Topsoil and Sulphide Tailings

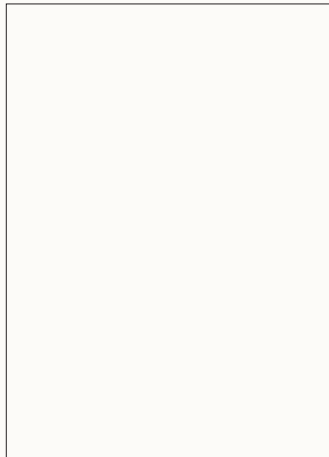


Plate 28: Western Grey Box Root
System in Topsoil

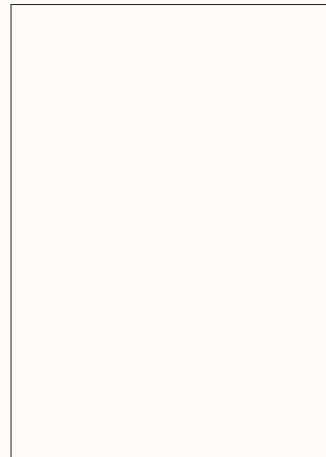


Plate 29: Western Grey Box Root
System in Oxide Tailings



Plate 30: Western Grey Box Root
System in Sulphide Tailings

Based on the results and observations from this vegetation growth trial, it is considered that CGO tailings material would unlikely be a significant constraint to plant growth and the selected salt tolerant tree species would likely establish and develop when planted on the top surfaces of the TSFs.

To expand on these trials, large scale vegetation growth trials using 1 m x 1 m boxes are proposed to be undertaken including selected tree and shrub species planted in various combinations and depths of tailings, subsoil and topsoil substrate materials (with hay mulch surface treatments) (compared to a control). The boxes would be placed proximal to the TSFs. A description of the proposed trial is provided in Section 3.4.

Plant Root Growth Assessment

During 2012, soil was excavated from around the root zone of four tubestock planted in 2010 in the southern waste rock emplacement trial area to assess plant root growth. The four seedlings included two *Eucalyptus camaldulensis* (River Red Gum) and two *Eucalyptus populnea* (Bimble Box or Poplar Box) and ranged from approximately 70 cm to 100 cm in height (DnA Environmental, 2013a) (Plates 31 to 38). All plants were observed to be small for two year old plants which could be attributed to the dry conditions that prevailed at the time of and following planting, and given no watering of the tubestock was undertaken at the time of planting (DnA Environmental, 2013a).

Observations indicated that the plant root systems were well developed and had persisted through substrates including layers of either topsoil and oxide waste (Plates 32 and 34) or topsoil, subsoil and oxide waste (Plates 36 and 38). The root system of one plant was however observed to reduce in size and change direction once the roots entered the oxide waste rock layer (DnA Environmental, 2013a) (Plate 32). This is considered a result of the strongly saline and alkaline nature of the oxide waste rock (DnA Environmental, 2013a).

Notwithstanding the nature of the oxide waste, the root systems of three of the four tubestock plants continued to develop within the substrates of the southern waste rock emplacement trial area (DnA Environmental, 2013a). Due to the small sampling size, there was no consistent and conclusive evidence that suggests that the seedling roots do not or cannot penetrate the strata used in this rehabilitation site (DnA Environmental, 2013a).

Recent observations of the plantings on the southern waste rock emplacement trial area indicate ongoing growth and development of the planted tubestock, as can be seen in Plate 13. A follow-up plant root growth assessment is proposed to be undertaken in southern waste rock emplacement trial area to assess plant root growth since 2012.

A plant root growth assessment is also proposed to be undertaken on various tubestock planted in the northern waste rock emplacement trial area to assess root development within the oxide substrate and surface rehabilitation media (Section 2.4.1). The works would include an increased sample size than undertaken at the southern waste rock emplacement trial area.

Revegetation Species for CGO Rehabilitation

As described in Section 2.4.1, DnA Environmental (2013b) has developed an indicative list of species considered suitable for use as tubestock for CGO rehabilitation areas (Table 2).

Evolution, in consultation with DnA Environmental and Diversity Native Seeds (a local seed supplier), has also developed a native seed mix species list considered suitable for direct seeding of CGO rehabilitation areas (Tables 3a and 3b). Separate lists have been developed for species suited to upper slopes (Table 3a) and lower slopes (Table 3b) of CGO landforms, with mid slopes using an intergrade of both the upper and lower slopes species.

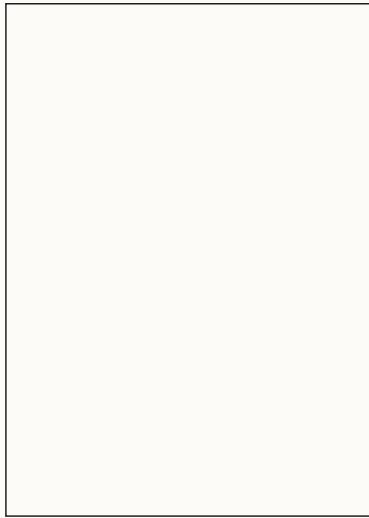
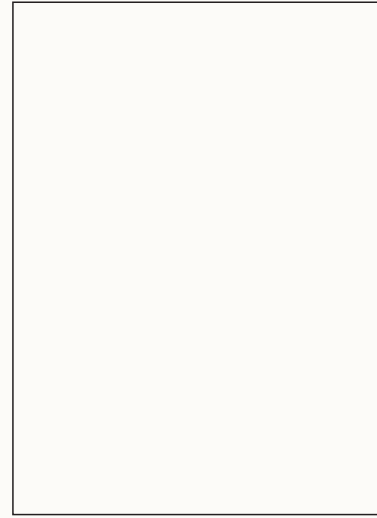


Plate 31: Tree 1 River Red Gum Tubestock



**Plate 32: River Red Gum Root System
through Soil Profile including
Topsoil and Oxide Waste Rock**

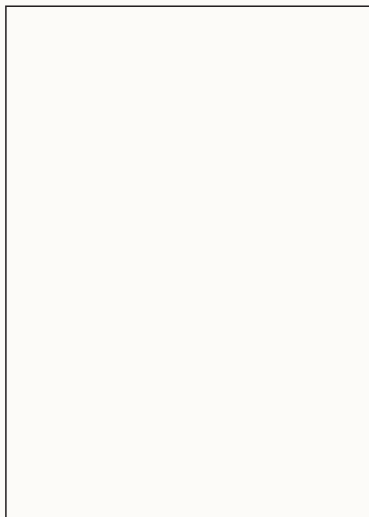
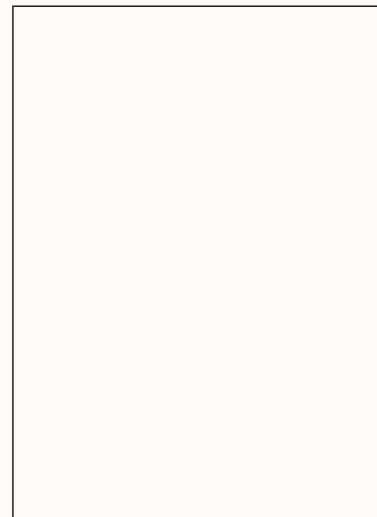


Plate 33: Tree 2 Bimble Box Tubestock



**Plate 34: Bimble Box Root System
through Soil Profile including
Topsoil and Oxide Waste Rock**

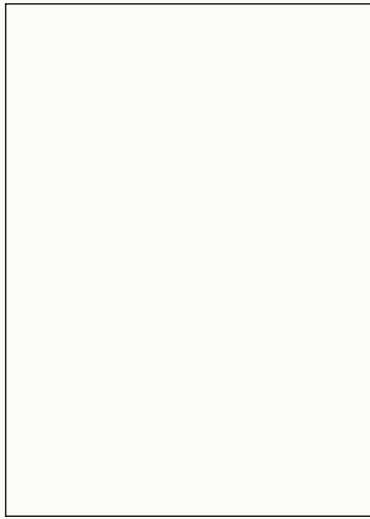


Plate 35: Tree 3 River Red Gum Tubestock

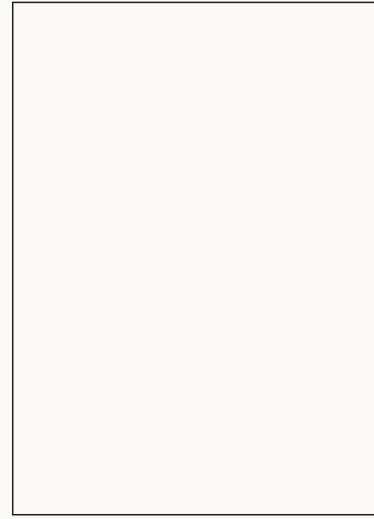


Plate 36: River Red Gum Root System through Soil Profile including Topsoil, Subsoil and Oxide Waste Rock

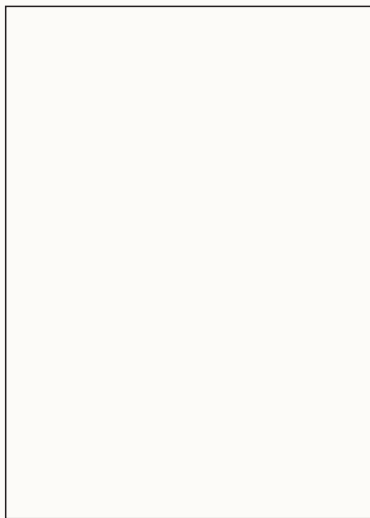


Plate 37: Tree 4 Bimble Box Tubestock

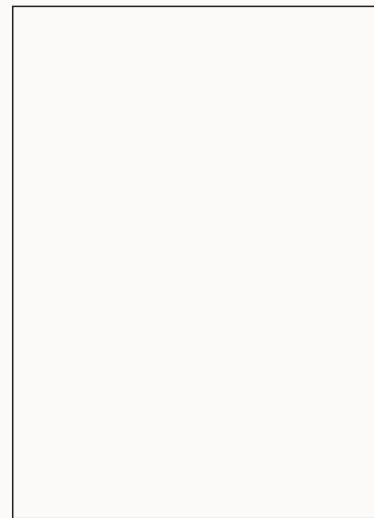


Plate 38: Bimble Box Root System through Soil Profile including Topsoil, Subsoil and Oxide Waste Rock

Consistent with approved rehabilitation objectives, the revegetation species lists include local endemic native tree, shrub and grass species associated with woodland vegetation communities suited to slopes, ridges and hills.

Results from the northern waste rock emplacement trial would be used to inform and refine (if necessary) the revegetation species lists (and the CGO rehabilitation cover material concepts) for the CGO waste rock emplacements.

Table 2
List of Species Suitable for Use as Tubestock

Scientific Name	Common Name	Type
<i>Callitris endlicheri</i>	Black Cypress Pine	Tree
<i>Allocasuarina leuhmannii</i>	Buloke	Tree
<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	Tree
<i>Eucalyptus microcarpa</i>	Grey Box	Tree
<i>Eucalyptus populnea</i>	Bimble Box	Tree
<i>Eucalyptus sideroxylon</i>	Mugga Ironbark	Tree
<i>Geijera parviflora</i>	Wilga	Tree
<i>Alectryon oleifolius</i>	Western Rosewood	Tree
<i>Brachychiton populneus</i>	Kurrajong	Tree
<i>Pittosporum angustifolium</i>	Butterbush	Tree
<i>Apophyllum anomalum</i>	Warrior Bush	Shrub/sub-shrub
<i>Allocasuarina verticillata</i>	Drooping Sheoak	Shrub/sub-shrub
<i>Chenopodium nitrariaceum</i>	Nitre Goosefoot	Shrub/sub-shrub
<i>Senna artemisioides subsp.</i>	Senna, Silver Cassia	Shrub/sub-shrub
<i>Indigofera australis</i>	Hill Indigo, Australian Indigo	Shrub/sub-shrub
<i>Acacia deanei</i>	Green Wattle	Shrub/sub-shrub
<i>Acacia doratoxylon</i>	Spearwood	Shrub/sub-shrub
<i>Acacia hakeoides</i>	Hakea Wattle	Shrub/sub-shrub
<i>Acacia oswaldii</i>	Miljee	Shrub/sub-shrub
<i>Acacia parviflora</i>	Wattle	Shrub/sub-shrub
<i>Eremophila longifolia</i>	Emubush	Shrub/sub-shrub
<i>Eremophila mitchellii</i>	Budda	Shrub/sub-shrub
<i>Myoporum montanum</i>	Western Boobialla	Shrub/sub-shrub
<i>Hakea tephrosperma</i>	Hooked-leaved Needlewood	Shrub/sub-shrub
<i>Santalum acuminatum</i>	Sweet Quandong	Shrub/sub-shrub
<i>Dodonaea viscosa subsp. cuneata</i>	Wedge-leaf Hopbush	Shrub/sub-shrub

Source: DnA Environmental (2016a)

Table 3a
List of Species Suitable for Use in Native Seed Mix – Upper Slopes

Landform Slope	Scientific Name	Common Name	Type
Upper Slopes	<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	Dominant Tree
	<i>Eucalyptus dealbata</i>	Tumbledown Red Gum	Dominant Tree
	<i>Eucalyptus sideroxylon</i>	Mugga Ironbark	Dominant Tree
	<i>Brachychiton populneus</i>	Kurrajong	Sub-dominant Tree
	<i>Callitris endlicheri</i>	Black Cypress Pine	Sub-dominant Tree
	<i>Geijera parviflora</i>	Wilga	Sub-dominant Tree
	<i>Pittosporum angustifolium</i>	Butterbush	Sub-dominant Tree
	<i>Acacia doratoxylon</i>	Spearwood	Sub-dominant Tree
	<i>Allocasuarina verticillata</i>	Drooping Sheoak	Sub-dominant Tree
	<i>Acacia deanei</i>	Green Wattle	Shrub
	<i>Acacia hakeoides</i>	Hakea Wattle	Shrub
	<i>Indigofera australis</i>	Australian Indigo	Shrub
	<i>Acacia decora</i>	Western Silver Wattle	Shrub
	<i>Acacia parviflora</i>	Wattle	Shrub
	<i>Hardenbergia violacea</i>	False Sarsparilla	Shrub
	<i>Cassinia laevis</i>	Cough Bush	Shrub
	<i>Dodonaea truncatiales</i>	Angular Hopbush	Shrub
	<i>Senna artemesioides subsp. zygophylla</i>	-	Shrub
	<i>Ajuga australis</i>	Austral Bugle	Forb/Sub-shrub
	<i>Arthropodium minus</i>	Small Vanilla Lily	Forb/Sub-shrub
	<i>Atriplex semibaccata</i>	Creeping Saltbush	Forb/Sub-shrub
	<i>Atriplex spinebractea</i>	Spiny-fruited Saltbush	Forb/Sub-shrub
	<i>Calotis cuneifolia</i>	Purple Burr-daisy	Forb/Sub-shrub
	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Forb/Sub-shrub
	<i>Chenopodium desertorum</i>	Desert Goosefoot	Forb/Sub-shrub
	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	Forb/Sub-shrub
	<i>Einadia hastata</i>	Berry Saltbush	Forb/Sub-shrub
	<i>Einadia nutans</i>	Climbing Saltbush	Forb/Sub-shrub
	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Forb/Sub-shrub
	<i>Gonocarpus tetragynus</i>	Common Raspwort	Forb/Sub-shrub
	<i>Podolepis neglecta</i>	Copper Wire Daisy	Forb/Sub-shrub
	<i>Pomax umbellata</i>	Pomax	Forb/Sub-shrub
	<i>Rhodanthe corymbiflora</i>	Small White Sunray	Forb/Sub-shrub
	<i>Swainsona galegifolia</i>	Smooth Darling-pea	Forb/Sub-shrub
	<i>Vittadinia sp.</i>	Fuzzweed	Forb/Sub-shrub
	<i>Wahlenbergia sp.</i>	Bluebell	Forb/Sub-shrub
	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Forb/Sub-shrub
	<i>Xerochrysum viscosum</i>	Sticky Everlasting	Forb/Sub-shrub
	<i>Austrostipa densiflora</i>	Foxtail Speargrass	Grass
	<i>Austrostipa scabra</i>	Speargrass	Grass
	<i>Austrostipa spp.</i>	-	Grass
	<i>Bothriochloa macra</i>	Red-leg Grass	Grass
	<i>Chloris truncata</i>	Windmill Grass	Grass
	<i>Panicum effusum</i>	Hairy Panic	Grass
	<i>Austrodanthonia sp.</i>	Wallaby Grass	Grass
	<i>Elymus scaber</i>	Common Wheatgrass	Grass
	<i>Microlaena stipoides</i>	Weeping Grass	Grass
	<i>Themeda australis</i>	Kangaroo Grass	Grass
	<i>Walwhalleya proluta</i>	Rigid Panic	Grass

Source: DnA Environmental and Diversity Native Seeds (2016a)

Table 3b
List of Species Suitable for Use in Native Seed Mix – Lower Slopes

Landform Slope	Scientific Name	Common Name	Type
Lower Slopes	<i>Eucalyptus dwyeri</i>	Dwyer's Red Gum	Dominant Tree
	<i>Eucalyptus microcarpa</i>	Grey Box	Dominant Tree
	<i>Eucalyptus populnea</i>	Bimble Box	Dominant Tree
	<i>Eucalyptus sideroxylon</i>	Mugga Ironbark	Dominant Tree
	<i>Brachychiton populneus</i>	Kurrajong	Sub-dominant Tree
	<i>Callitris glaucophylla</i>	White Cypress Pine	Sub-dominant Tree
	<i>Geijera parviflora</i>	Wilga	Sub-dominant Tree
	<i>Pittosporum angustifolium</i>	Butterbush	Sub-dominant Tree
	<i>Acacia doratoxylon</i>	Spearwood	Sub-dominant Tree
	<i>Acacia pendula</i>	Weeping Myall	Sub-dominant Tree
	<i>Allocasuarina leuhmannii</i>	Buloke	Sub-dominant Tree
	<i>Acacia cardiophylla</i>	Wyalong Wattle	Shrub
	<i>Acacia deanei</i>	Green Wattle	Shrub
	<i>Acacia hakeoides</i>	Hakea Wattle	Shrub
	<i>Acacia rigens</i>	Needle Wattle	Shrub
	<i>Indigofera australis</i>	Australian Indigo	Shrub
	<i>Acacia decora</i>	Western Silver Wattle	Shrub
	<i>Acacia lineata</i>	Streaked Wattle	Shrub
	<i>Acacia oswaldii</i>	Miljee	Shrub
	<i>Acacia parviflora</i>	Wattle	Shrub
	<i>Hardenbergia violacea</i>	False Sarsparilla	Shrub
	<i>Cassinia laevis</i>	Cough Bush	Shrub
	<i>Dodonaea truncatiales</i>	Angular Hopbush	Shrub
	<i>Dodonaea viscosa subsp. cuneata</i>	Wedge-leaf Hop-bush	Shrub
	<i>Myoporum montanum</i>	Western Boobialla	Shrub
	<i>Senna artemesioides subsp. zygophylla</i>	-	Shrub
	<i>Ajuga australis</i>	Austral Bugle	Forb/Sub-shrub
	<i>Arthropodium minus</i>	Small Vanilla Lily	Forb/Sub-shrub
	<i>Atriplex semibaccata</i>	Creeping Saltbush	Forb/Sub-shrub
	<i>Atriplex spinebractea</i>	Spiny-fruited Saltbush	Forb/Sub-shrub
	<i>Calotis cuneifolia</i>	Purple Burr-daisy	Forb/Sub-shrub
	<i>Calotis lappulacea</i>	Yellow Burr-daisy	Forb/Sub-shrub
	<i>Chenopodium desertorum</i>	Desert Goosefoot	Forb/Sub-shrub
	<i>Chenopodium nitrariaceum</i>	Nitre Goosefoot	Forb/Sub-shrub
	<i>Chrysocephalum semipapposum</i>	Clustered Everlasting	Forb/Sub-shrub
	<i>Einadia hastata</i>	Berry Saltbush	Forb/Sub-shrub
	<i>Einadia nutans</i>	Climbing Saltbush	Forb/Sub-shrub
	<i>Enchylaena tomentosa</i>	Ruby Saltbush	Forb/Sub-shrub
	<i>Podolepis neglecta</i>	Copper Wire Daisy	Forb/Sub-shrub
	<i>Pomax umbellata</i>	Pomax	Forb/Sub-shrub
	<i>Rhodanthe corymbiflora</i>	Small White Sunray	Forb/Sub-shrub
	<i>Swainsona galegifolia</i>	Smooth Darling-pea	Forb/Sub-shrub
	<i>Vittadinia</i> spp.	Fuzzweed	Forb/Sub-shrub
	<i>Wahlenbergia</i> spp.	Bluebell	Forb/Sub-shrub
	<i>Xerochrysum bracteatum</i>	Golden Everlasting	Forb/Sub-shrub
<i>Xerochrysum viscosum</i>	Sticky Everlasting	Forb/Sub-shrub	
<i>Austrostipa densiflora</i>	Foxtail Speargrass	Grass	
<i>Austrostipa scabra</i>	Speargrass	Grass	
<i>Austrostipa</i> spp.	-	Grass	

Table 3b (Continued)
List of Species Suitable for Use in Native Seed Mix – Lower Slopes

Landform Slope	Scientific Name	Common Name	Type
Lower Slopes (continued)	<i>Bothriochloa macra</i>	Red-leg Grass	Grass
	<i>Chloris truncata</i>	Windmill Grass	Grass
	<i>Digitaria brownii</i>	Cotton Panic Grass	Grass
	<i>Digitaria coenicola</i>	Finger Panic Grass	Grass
	<i>Digitaria divaricatissima</i>	Umbrella Grass	Grass
	<i>Eragrostis spp.</i>	Lovegrasses	Grass
	<i>Panicum effusum</i>	Hairy Panic	Grass
	<i>Paspalidium constrictum</i>	Knottybutt Grass	Grass
	<i>Austrodanthonia sp.</i>	Wallaby Grass	Grass
	<i>Dichanthium sericeum</i>	Queensland Bluegrass	Grass
	<i>Elymus scaber</i>	Common Wheatgrass	Grass
	<i>Enteropogon acicularis</i>	Curly Windmill Grass	Grass
	<i>Eriochloa crebra</i>	Cup Grass	Grass
	<i>Eulalia aurea</i>	Silky Browntop	Grass
	<i>Microlaena stipoides</i>	Weeping Grass	Grass
	<i>Sporobolus carolii</i>	Fairy Grass	Grass
	<i>Sporobolus creber</i>	Western Rat-tail Grass	Grass
<i>Themeda australis</i>	Kangaroo Grass	Grass	
<i>Walwhalleya proluta</i>	Rigid Panic	Grass	

Source: DnA Environmental and Diversity Native Seeds (2016a)

2.4.5 Key Findings of Investigations and Trials

Key findings of the rehabilitation investigations and trials conducted at the CGO to date include the following (Sections 2.4.1 to 2.4.4):

- The surface cover treatment/method most likely to stabilise final landform slopes and support long-term vegetation growth includes (DnA Environmental, 2013a, 2013b; 2015):
 - rock mulch and gypsum-treated topsoil cross-ripped along the contour of the slope; and
 - a light to medium application of native pasture hay or clean wheaten straw hay as an immediate protective soil cover.
- The annual exotic grass *Lolium rigidum* (Wimmera Ryegrass) present in the topsoil seed bank establishes rapidly in high abundance across rehabilitation areas, providing extensive vegetation cover and soil/surface protection, and a mulch/litter cover once it desists. As a result, hay mulch is only considered necessary in areas where *Lolium rigidum* (Wimmera Ryegrass) has not established.
- Research is proposed to determine the most effective methods for direct seeding rehabilitation areas following the establishment of the initial Wimmera Ryegrass cover crop.
- At this stage, no obvious effects have been observed on the growth rates of the tubestock in the northern waste rock emplacement trial as a result of the different topsoil depths or mulch treatments or underlying waste rock substrate types.
- Primary waste rock is suitable for use as rock armour (or rock mulch) on landform slopes due to the material being typically non-saline and NAF (GEM, 2008; 2013; 2016). However, primary waste rock materials with higher reactive sulphide contents (greater than 0.5% sulphur) are likely to present a risk of developing saline conditions when oxidised and these materials should either be excluded from use as rock armour or blended with the lower sulphur material in order to dilute the reactive sulphides (GEM, 2008; 2013; 2016).

- Due to the expected salinity and sodicity of the oxidised waste rock, this material is not suitable for armouring the batter slopes of the waste rock emplacements and TSFs.
- Due to the sodic and dispersive nature of the oxide waste rock material, gypsum should be spread on the surface of oxide waste rock material (i.e. in particular on the southern waste rock emplacement) prior to the application of the rehabilitation cover materials (e.g. rock mulch and gypsum-treated topsoil) to assist with stabilising the underlying substrate material.
- The inclusion of rock mulch in the surface cover placed on CGO landform slopes would provide resistance to erosion and would reduce surface water flow velocities on landform slopes during high rainfall events (Gilbert and Associates, 2009).
- The majority of stockpiled soil resources at the CGO are typically sodic and dispersive and therefore require treatment with gypsum to improve the soil structure and suitability for plant growth (some soil stocks however require treatment with lime or a gypsum-lime blend to reduce the acidity of the soil) (McKenzie Soil Management, 2013).
- Various methods for treating or ameliorating soil at the CGO have been recommended by McKenzie Soil Management (2013), including treating soil stockpiles with gypsum (or other relevant treatment material); treating strongly sodic and dispersive soil stocks with gypsum in a dedicated soil amelioration farm; treating soil when re-applied to rehabilitation areas; and spreading gypsum on the surface of original soil profiles prior to soil stripping.
- Ameliorated soils are anticipated to improve revegetation outcomes for the CGO final landforms (due to improved soil properties for plant growth) and may increase the number and diversity of revegetation species able to be used in the CGO rehabilitation programme (i.e. additional species could be used that are typically less tolerant to deficient soils) (McKenzie Soil Management, 2013). Soil conditioning (with gypsum) and the application of surface cover treatments improves the effectiveness of revegetation techniques including direct seeding and tubestock planting (DnA Environmental, 2013a).
- The results from vegetation growth trials undertaken to date indicate that seedlings of select salt tolerant tree species continued to grow when planted in a substrate including CGO oxide and sulphide tailings (Barrick, 2013b). As a result, it is considered salt tolerant tree species would likely establish and develop when planted on the top surfaces of the TSFs.
- The root systems of two year old tree species planted in substrates including topsoil and oxide waste rock and topsoil, subsoil and oxide waste rock continued to grow through the substrate profile (except for one plant where the root system desisted once entering oxide waste rock) (DnA Environmental, 2013a). Despite the small sampling size, there was no conclusive evidence to suggest these substrates would be a significant constraint to plant growth (DnA Environmental, 2013a).

Based on the above key findings, the current rehabilitation programme for the CGO includes:

- The following surface cover treatment to stabilise final landform slopes and support long-term vegetation growth:
 - rock mulch and gypsum-treated topsoil cross-rippled along the contour of the slope; and
 - in areas where *Lolium rigidum* (Wimmera Ryegrass) has not established, a light to medium application of native pasture hay or clean wheaten straw hay to provide an immediate protective soil cover.
- The application of gypsum and then a layer of primary waste rock placed on areas of oxide waste rock on the top surface (and batters) of the southern waste rock emplacement (which has largely been constructed of oxide waste rock material) to assist with stabilising the sodic and dispersive characteristics of the oxide waste rock material.

- Implementation of various soil amelioration methods to improve the structure and function of soil stocks to enhance suitability for plant growth (Section 3.5.2) including:
 - treating soil with gypsum when re-applied to rehabilitation areas;
 - treating soil stockpiles with gypsum (or other relevant treatment material); and
 - spreading gypsum on the surface of original soil profiles prior to soil stripping.
- Continued rehabilitation investigations and trials to determine:
 - the most effective combinations of the rock mulch and topsoil cover system materials; and
 - the most effective methods for managing *Lolium rigidum* (Wimmera Ryegrass) to maintain its benefits yet provide for the establishment of native tree and shrub species from seed (Section 3.4).

These findings have been incorporated into the rehabilitation programme for the Modification (Section 3).

3 REHABILITATION OF THE MODIFICATION

3.1 REHABILITATION PRINCIPLES

The approved CGO rehabilitation philosophy is to operate as a non-intrusive land user and to create stable rehabilitated landforms that increase the areas of endemic vegetation in the mine area and the status of land-lake habitats (Barrick, 2013a). This philosophy has led to the rehabilitation principles and objectives as described below.

The rehabilitation programme would include the following general principles:

- The rehabilitation of landforms is to be progressive and conducted in accordance with approved, verified plans.
- Final landforms are to be stable in the long-term and include native and/or endemic vegetation characteristic of remnant vegetation within the surrounding landscape.
- Endemic groundcover, understorey, tree seeds and seedlings are to be cultivated and used in the rehabilitation programme.
- Rehabilitation concepts are to be flexible to allow for adjustments, based on investigations, to improve the rehabilitation programme.
- The annual rehabilitation programme and budget is to be prepared by a site team incorporating senior management representatives.

3.2 REHABILITATION OBJECTIVES

The rehabilitation objectives for the Modification would include:

- The water quality of Lake Cowal is not detrimentally affected by CGO landforms.
- Revegetating CGO landforms with selected native and/or endemic vegetation that is suited to the physiographic and hydrological features of each landform, and which expand on the areas of remnant endemic vegetation in the surrounding landscape.
- Designing final landforms so that they are stable and include revegetation growth materials that are suited to the landform and support self-sustaining vegetation.
- The placement (wherever possible) of soils on final landforms to enable the progressive establishment of vegetation.
- The expansion of habitat opportunities for wetland and terrestrial fauna species. This includes the design and implementation of rehabilitation works at the New Lake Foreshore in a manner consistent with the *NSW Wetlands Policy* (NSW Department of Environment, Climate Change and Water, 2010).
- The selection of revegetation species in accordance with accepted principles of long-term sustainability (e.g. genotypic variation, vegetation succession, water/drought tolerances).
- Grazing of land within ML 1535 to be excluded during operations and during rehabilitation of the site. At lease relinquishment, rehabilitated final landforms are excluded from grazing, with some areas suitable for grazing surrounding the rehabilitated final landforms.

3.3 FINAL LANDFORM CONCEPTS AND REHABILITATION DOMAINS

The currently approved final landform design concepts (Section 2.2) would remain unchanged for the Modification.

The Modification would not change the CGO's key final landforms which would include:

- a final void;
- rehabilitated waste rock emplacements surrounding the final void to the north, east and south;
- two rehabilitated TSFs located near the western extent of ML 1535;
- a woodland corridor between the rehabilitated northern waste rock emplacement and rehabilitated northern TSF;
- areas surrounding the rehabilitated waste rock emplacements and TSFs associated with rehabilitated site infrastructure areas (e.g. former process plant area and former soil stockpile areas);
- permanent water management features including the UCDS and low mounds associated with the ICDS; and
- permanent lake isolation embankments to hydrologically separate the open pit development area and Lake Cowal during mining and post-mining.

The Modification would involve processing of mineralised material and would therefore remove the mineralised material stockpile as a component of the northern waste rock emplacement landform. Figure 8 shows the conceptual general arrangement post-mining. Figure 5 shows the conceptual final landforms and proposed long-term land use areas.

Consistent with the DRE's (2013) *ESG3: Mining Operations Plan (MOP) Guidelines September 2013* (MOP Guidelines), conceptual rehabilitation domains have been developed based on the CGO final landforms (Table 4) which are shown on Figure 9.

**Table 4
Primary and Secondary Rehabilitation Domains**

Code	Primary Domain	Code	Secondary Domain
1	Void	A	Final Void
2	Permanent Water Management Infrastructure	B	Permanent Water Management Infrastructure
3	Infrastructure Area	C	Grassland/Scattered Eucalypt Woodland
4	Tailings Storage Facilities	D	Eucalypt Woodland
5	Waste Rock Emplacements	E	Riverine Woodland/Freshwater Communities
6	Woodland Corridor		
7	New Lake Foreshore		

In summary, the conceptual rehabilitation domains include:

- Domain 1A – Final Void;
- Domain 2B – Permanent Water Management Infrastructure;
- Domain 3C – Infrastructure Area – Grassland/Scattered Eucalypt Woodland;
- Domain 4D – Tailings Storage Facilities – Eucalypt Woodland;
- Domain 5D – Waste Rock Emplacements – Eucalypt Woodland;
- Domain 6D – Woodland Corridor – Eucalypt Woodland; and
- Domain 7E – New Lake Foreshore – Riverine Woodland/Freshwater communities.



- LEGEND**
- Mining Lease Boundary (ML 1535)
 - Road
 - Contour m AHD (2 m Interval)
 - Rehabilitated Area
 - Final Void
 - Final Void Batter
 - Drainage Channel
 - Swale

Note: Landform elevations are approximate

Source: Evolution (2016)



CGO MINE LIFE MODIFICATION
Conceptual General Arrangement
Post-mining

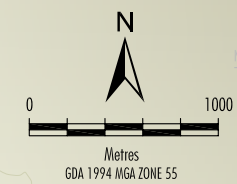
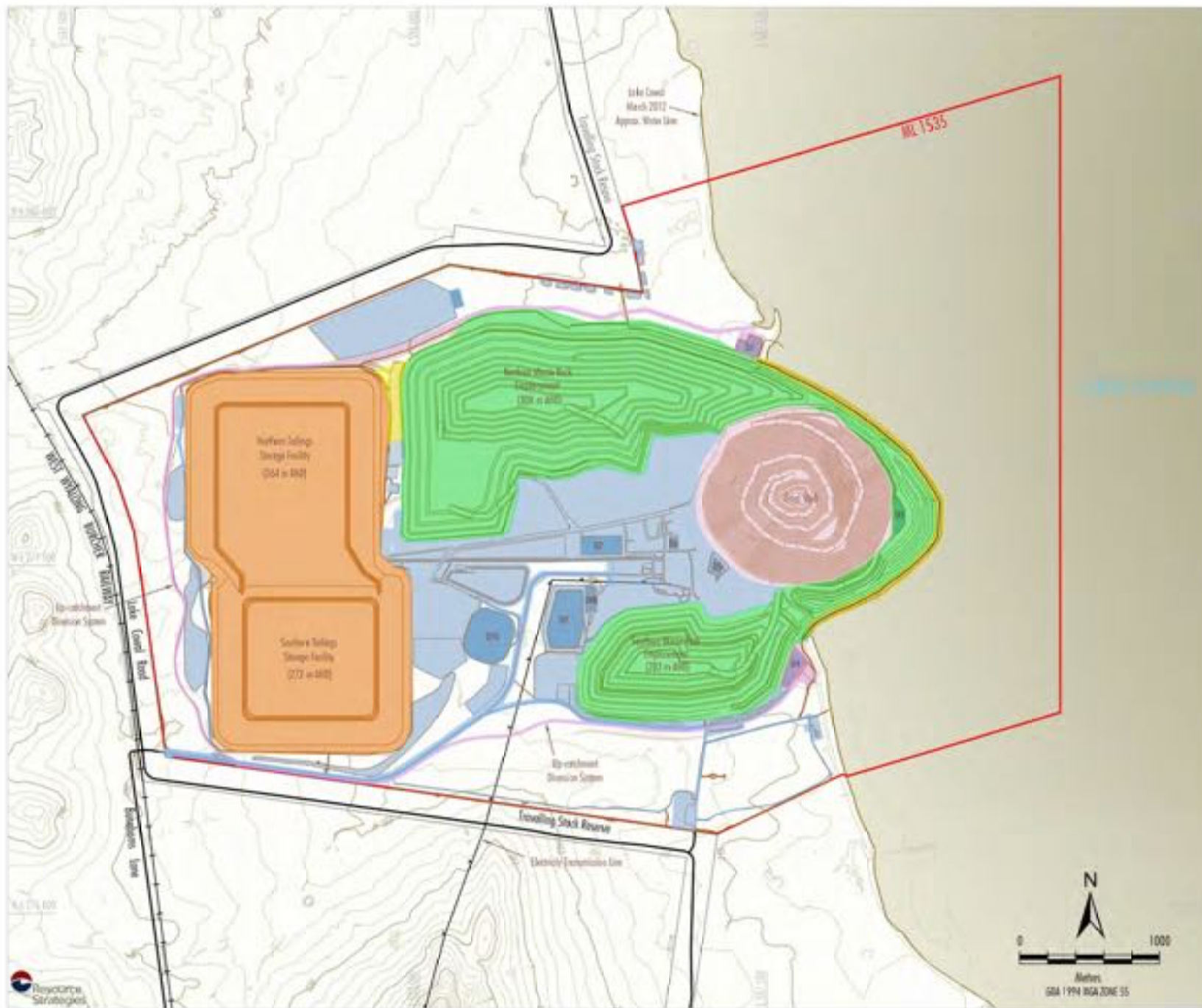


Figure 8



- LEGEND**
- Mining Lease Boundary (ML 1535)
 - Road
 - Contour m AHD (2 m Interval)
 - Domain**
 - Final Void
 - Permanent Water Management Infrastructure
 - Infrastructure Area - Grassland/Scattered Eucalypt Woodland
 - Tailings Storage Facility - Eucalypt Woodland
 - Waste Rock Emplacement - Eucalypt Woodland
 - Woodland Corridor - Eucalypt Woodland
 - New Lake Foreshore - Riverine Woodland and Freshwater Communities

Note: Contours/elevations are approximate
Source: Evolution (2016)



C60 MINE LIFE MODIFICATION
Conceptual Rehabilitation Domains



Figure 9

The rehabilitation objectives and final landform and revegetation concepts for each domain/key final landform are described in Sections 3.3.1 to 3.3.7 and are consistent with the rehabilitation principles (Section 3.1) and rehabilitation objectives (Section 3.2) for the Modification. The long-term land use strategy for the approved CGO (Section 2.3) would remain unchanged for the Modification.

These concepts and the long-term land use strategy may be revised and refined if necessary throughout the life of the mine based on the outcomes of ongoing consultation with relevant regulatory authorities, stakeholders and the results of ongoing rehabilitation investigations and trials.

3.3.1 Domain 1A – Final Void

The rehabilitation objectives for the final void would remain unchanged for the Modification and are to (Barrick, 2013a):

- create habitat opportunities for waterbirds at the approximate level at which void water will reach equilibrium, where feasible; and
- leave the void surrounds safe (for humans and stray stock).

At the completion of mining, the final void would be surrounded on three sides by the revegetated mine waste rock emplacements.

The Modification would increase the maximum final depth of the final void to approximately -331 m AHD (i.e. approximately 540 m below the natural surface level). The berm widths and slope angles would continue to be reviewed and monitored through ongoing geotechnical studies and data collection during mine development.

A description of the long-term hydrological characteristics for the modified final void is presented in the *Cowal Gold Operations Mine Life Modification Hydrological Assessment* (HEC, 2016) (Appendix B to the *Cowal Gold Operations Mine Life Modification Environmental Assessment*). Modelling indicates that the final void water level would be even lower than the final void level predicted in the previous *Cowal Gold Mine Extension Modification Hydrological Assessment* (Gilbert and Associates, 2013) (i.e. the water level is predicted to reach an equilibrium water level lower than approximately RL 130 m [approximately 80 m below spill level]) (HEC, 2016). Predictions of average void salinity confirm that salt concentrations in void waters would slowly increase towards hyper-salinity (HEC, 2016).

A bund would be constructed around the perimeter of the final void which would be planted with an initial cover crop (to assist in stabilising the bund following construction) and would then be seeded with native and/or endemic Eucalypt woodland species. The final void would be screened from public views on Lake Cowal Road by the TSFs and waste rock emplacements and would be fenced upon completion of mining. Signposted warnings to the public would also be placed along the fence.

3.3.2 Domain 2B – Permanent Water Management Infrastructure

The rehabilitation objective for the permanent water management structures is to create stable systems (i.e. acceptably low risk of environmental harm to Lake Cowal).

The Modification would not change the existing permanent water management structures which comprise:

- the UCDS; and
- the ICDS (including the existing low mounds associated with the permanent catchment divide).

The UCDS has been constructed to simulate endemic drainage features in the region and includes a low flow drainage path within a wider floodplain (approximately 65 m wide). The channel includes constructed features such as low flow and overbank zones, meanders and pool/riffle sequences. The northern extent of the UCDS includes constructed rock outfalls at confluences with existing natural drainage lines to minimise erosion. At the completion of construction, the UCDS was revegetated with riparian vegetation including rapid germinating pasture species to assist in stabilising the channel.

The UCDS would remain to facilitate permanent drainage of adjacent areas upslope of the site to Lake Cowal and the low mounds associated with the ICDS would remain to contain runoff generated within the site catchment.

Although some components of the Lake Isolation System are permanent water management features (i.e. the lake protection bund and first outer batter of the perimeter waste rock emplacement, which will become the New Lake Foreshore at mine closure), the rehabilitation objectives and concepts for the New Lake Foreshore are different from the UCDS and ICDS. Therefore, a separate Rehabilitation Domain (7E) has been developed for the New Lake Foreshore (Section 3.3.7). The rehabilitation concepts for the remainder of the perimeter waste rock emplacement (i.e. excluding the first outer batter) will be the same as for the northern and southern waste rock emplacements (Section 3.3.5).

3.3.3 Domain 3C – Infrastructure Areas

Post-operations, the rehabilitation objectives for the infrastructure areas are to:

- remove all infrastructure to ensure the site is safe and free of hazardous materials (unless an alternative arrangement is agreed by Evolution, the ultimate landholder and relevant regulatory authorities); and
- establish vegetative communities (including scattered Eucalypt Woodland species and native pasture species) that are endemic to the region and suitable for managed grazing.

Infrastructure areas associated with the Modification would largely remain the same as the existing infrastructure areas at the approved CGO, except the small area in between the TSFs would become part of the TSF domain (Section 3.3.4)

Existing infrastructure which would continue to be used for the Modification would include the workshop, storage areas, process plant, administration, access roads, transmission line and substation, borefields, water management structures and exploration areas.

The general rehabilitation concepts for the infrastructure areas would remain unchanged for the Modification. A summary of these rehabilitation concepts is provided below.

The long-term objectives for site infrastructure features will be discussed during the life of the CGO and will be specifically reviewed in consultation with the Community Environmental Monitoring and Consultative Committee (CEMCC) and relevant regulatory authorities prior to the final year of mine operations.

Workshop

At the completion of mining, the mine fleet would be demobilised and the workshop dismantled. The footprint area would be tested for contamination from fuels and lubricants and any contaminated soils removed for proper disposal in accordance with EPA requirements. The area would then be contour ripped, topsoiled and revegetated with endemic Eucalypt Woodland and native pasture species.

Reagent and Fuel Storage Areas

Unused reagents and fuels at the completion of processing would be returned to the supplier in accordance with all relevant safety and handling procedures. Storage areas would be tested for contamination from fuels and lubricants and any contaminated soils removed for proper disposal in accordance with the EPA requirements. The area would then be contour ripped, topsoiled and revegetated with endemic Eucalypt Woodland and native pasture species.

Process Plant and Administration Area

The process plant and administration area buildings would be dismantled and removed following the cessation of processing.

The foundations and floors would be retained if a suitable alternative use is agreed with the ultimate landholder. Alternatively, they would be excavated for disposal at the base of the final void or as buried landfill in an approved manner. If the foundations and floors are removed, the area would then be contour ripped, topsoiled and revegetated with endemic Eucalypt Woodland and native pasture species.

Internal powerlines, pipelines and the explosives magazine would be dismantled and removed.

Internal Access Road and Other Roads

All internal roads would be contour ripped, topsoiled and revegetated with endemic Eucalypt Woodland and native pasture species, unless otherwise agreed with the ultimate landholder.

Transmission Line and Substation

At the end of the mine life, the electricity transmission line (from Temora to the CGO) would be the property of the electricity utility and would likely remain in place.

Water Supply Infrastructure

The Bland Creek Palaeochannel bores and associated pump stations (including the eastern pump station and diesel tank) may be transferred to local landholders or, alternatively, dismantled and the bores plugged, capped and decommissioned in accordance with the regulatory guidelines.

The pipeline would either be raised and dismantled for recycling or kept in place if required for local use. If dismantled, the section of pipeline in the bed of Lake Cowal would be raised when the lake is dry and disturbed areas revegetated with endemic species. If this is not possible due to successive high rainfall seasons, any decision to remove the pipeline would be discussed with the relevant regulatory authorities. However, given the likely maintenance period for CGO rehabilitation, it is likely that Lake Cowal would be sufficiently dry at some stage during this period.

Given the water supply from the saline groundwater supply bores within ML 1535 and the eastern saline borefield is highly saline, it is unlikely that these bores would be suitable and/or requested for ongoing future use by local landholders post-closure of the CGO. Notwithstanding, consultation would include discussions between Evolution and local landholders regarding potential transfer of the saline groundwater supply borefield infrastructure for private use.

It is likely, however, that the saline groundwater supply bores would be plugged, capped and decommissioned in accordance with the regulatory guidelines and the associated pipelines and pump systems dismantled. The pipeline within the ML 1535 within Lake Cowal would be dismantled and removed during dry lake conditions and disturbed areas revegetated with endemic species.

Contained Water Storages

Rehabilitation objectives for the contained water storages (i.e. D1 to D10) are to either decommission the infrastructure or retain the infrastructure for local landholder use. Decommissioning of the contained water storages would be undertaken to the satisfaction of relevant regulatory authorities including the DRE, EPA and DPI-Water. Alternatively, the contained water storages may be retained for local landholder use upon agreement by Evolution and the regulatory authorities.

Exploration Areas

All exploration drillholes would be plugged, capped and decommissioned in accordance with the regulatory guidelines at the completion of exploration activities. Access tracks and areas disturbed by exploration activities would be revegetated in accordance with the procedures adopted for the internal site roads.

3.3.4 Domain 4D – Tailings Storage Facilities

The Modification would involve modifying the design of the TSFs to:

- increase the final heights of the northern and southern TSFs to approximately 264 m AHD and 272 m AHD, respectively;
- convert the area between the existing TSFs into a new storage area; and
- place a rock fill buttress over the outer slopes of the TSF embankments to provide long-term stability.

Notwithstanding, the Modification would not change the approved rehabilitation objectives for the TSFs which would be:

- to establish permanently stable landforms;
- during operations, stabilise batters so that they provide minimal habitat value for bird life (i.e. rock mulch or pasture cover);
- post-operations, to establish vegetative communities (including Eucalypt and Riverine woodland species and understorey species such as Rush sp. and pasture species) which are suited to the hydrological features and substrate materials of the landform; and
- to exclude grazing and agricultural production.

The currently approved rehabilitation strategy for the TSFs at the completion of processing would also remain unchanged and would include the following:

- The decant areas would be allowed to dry and the decant towers would be permanently capped with fill and/or a concrete plug.
- The underdrains (which previously conveyed decanted water to the reclaim dam) would be grouted.
- The tailings discharge pipes and monitoring systems would be dismantled for re-use or disposal with the bulk of CGO infrastructure.
- The TSFs would be fenced during rehabilitation and post-mining to exclude grazing and agriculture production.

Embankment Construction

The TSFs would continue to be stage constructed with the height of the embankments raised in advance of the storage requirements. As the storages fill, the embankments would be raised in a series of upstream lifts, at a rate not more than approximately 5 m per year. Each lift would comprise an earth/rock fill embankment, with a clay basal zone, supported by the dry tailings beach.

Construction of each lift would also involve placement of an interim rock buttress cover on the outer slope of the embankment to enhance stability of the embankments during construction of the TSFs. Rehabilitation materials (e.g. rock mulch and topsoil) on the existing TSF embankments would be stripped prior to placement of the interim rock buttress. The stripped rehabilitation materials would then be either transferred to a new rehabilitation area or stockpiled proximal to the TSFs for use during final rehabilitation activities.

Once the final embankment of both TSFs has been constructed, a final rock buttress would be placed over the outer slopes of the TSF embankments to provide long-term stability. To accommodate the final rock buttress, a minor extension of the TSF footprints would occur within currently approved surface disturbance areas.

The overall slope of the TSF embankments would be 1V:4.8H for the northern tailings storage facility, 1V:4.5H for the southern tailings storage facility and 1V:3.6H for the central connector embankments.

Figures 10 and 11 show conceptual cross-sections of the modified northern tailings storage facility and central connector embankments, respectively. The conceptual cross-section of the modified northern tailings storage facility shown on Figure 10 is also representative of the concept for the southern tailings storage facility.

The design, construction, operation and monitoring of the TSFs would continue to be conducted in consultation with and to the satisfaction of Dams Safety NSW, and the design details provided in the revised Mining Operations Plan (MOP) for the Modification.

Rehabilitation Cover System

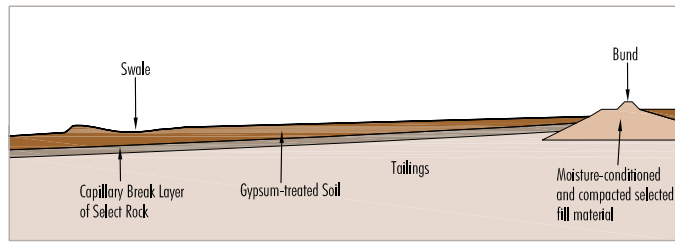
The Modification would involve no change to the rehabilitation concepts for the top surfaces of the TSFs. The top surfaces of the TSFs would form a low, internally draining landform, with drainage affected by controlled placement of cover materials and a number of shallow swales. The TSF surfaces would form contained catchments to minimise surface water runoff from the top surface down the batters. The rehabilitation cover system materials for the top surfaces would include a capillary break layer of rock, and layers of subsoil and topsoil.

The rehabilitation cover system for the TSF embankments would include spreading gypsum-treated topsoil over the surface of the final rock buttress and revegetating with select species suited to the slope and substrate materials of the embankment. The depth of soil cover applied would be informed by rehabilitation trial results.

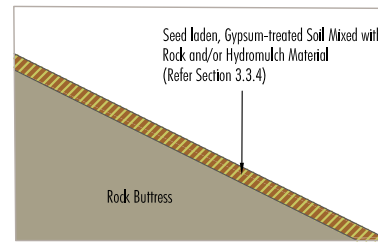
During operations, the TSF embankments would be constructed so that they provide minimal habitat value for bird life (i.e. rock mulch or pasture cover only).

Revegetation Concepts

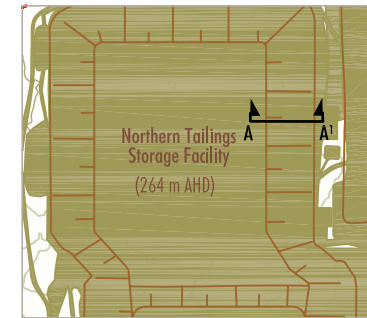
Similar to the revegetation concepts for the waste rock emplacements, revegetation concepts for the TSFs would include selecting species suited to the hydrological features and substrate materials of the landform and would be based on the results of rehabilitation investigations and trials in consultation with regulatory authorities.



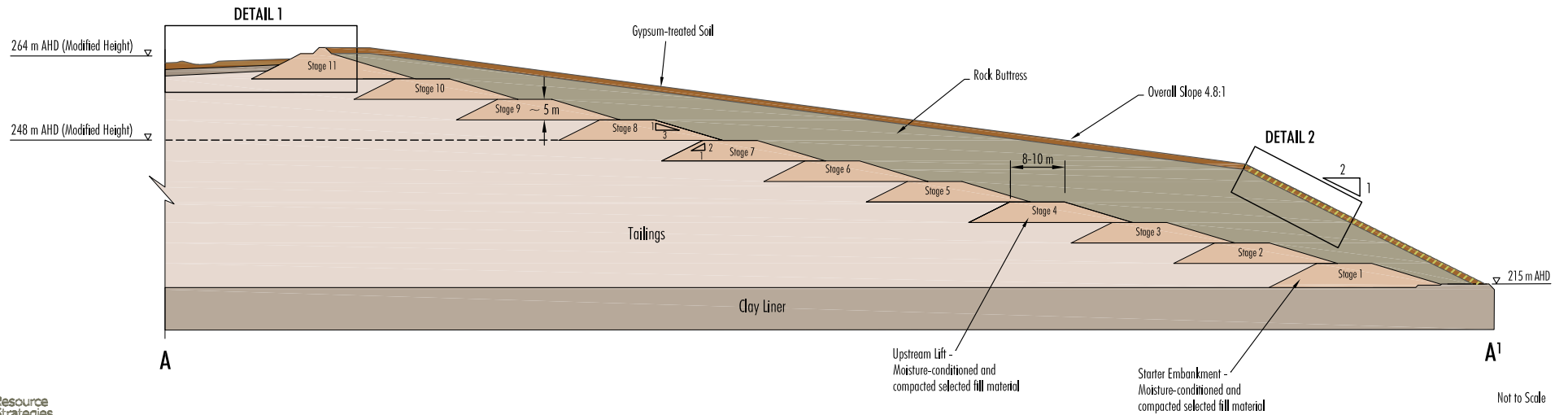
DETAIL 1



DETAIL 2



INSET
Refer Figure 8



Not to Scale

HAL-6-41 ML Mod AppRA_1038

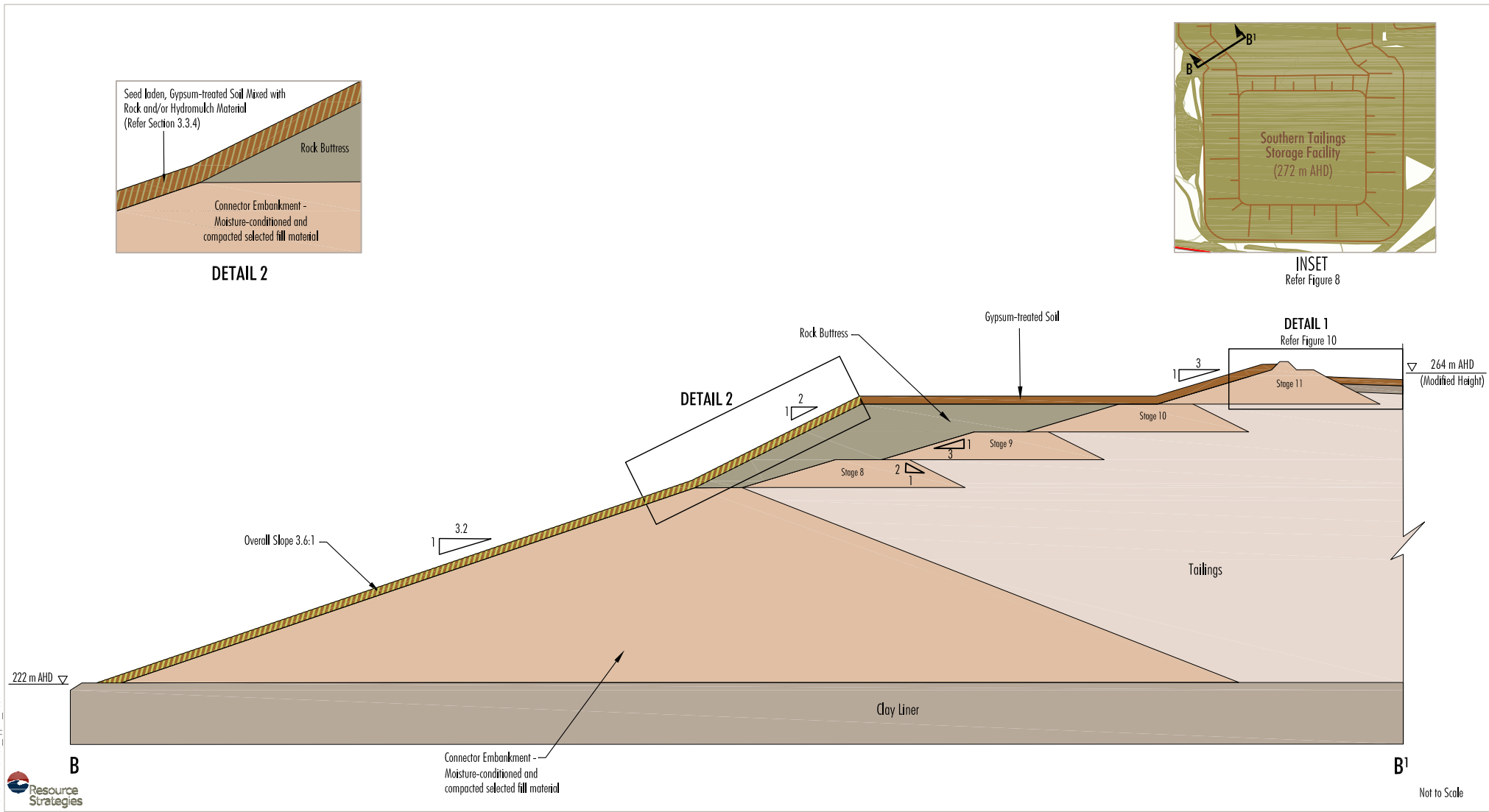


Source: AECOM (2016)



CGO MINE LIFE MODIFICATION
Conceptual Embankment Section of
Modified Northern Tailings Storage Facility

Figure 10



HAL-6-41 ML Mod AppRA_1058



Source: AECOM (2016)



CGO MINE LIFE MODIFICATION
Conceptual Embankment Section of
Tailings Storage Facility Connector
Embankment

Figure 11

The vegetation growth trials undertaken to date (Section 2.4.4) indicate that salt tolerant tree species including Belah, Grey Box, Bimble Box or Poplar Box, Mugga Ironbark and Buloke and shrub species including Green Wattle (*A. deanei*), Western Golden Wattle (*A. decora*), Weeping Myall (*A. pendula*), Wedge-leaf Hop-bush (*Dodonaea viscosa ssp. cuneata*) and Nitre Goosefoot (*C. nitrariaceum*) may be suitable for revegetation of the TSF top surfaces.

Based on the above, post-operations, revegetation concepts for the TSFs include:

- In the central, occasionally wet area, planting species such as River Red Gum and understory species such as Rush sp.
- On the remainder of the covered storage surface, planting salt tolerant Eucalypt and Riverine woodland species (including Belah, Grey Box, Bimble Box, Mugga Ironbark and Buloke tree species and Green Wattle, Western Golden Wattle, Weeping Myall, Wedge-leaf Hop-bush and Nitre Goosefoot shrub species).
- On the TSF embankments, planting species suited to the slope and substrate materials of the embankment.

Revegetation concepts would consider the results of hydrological modelling predictions for the TSFs (i.e. plant species would be selected that are suited to the hydrological conditions of the storages such as inundated areas, dry areas and swales).

Rehabilitation trials would continue to be undertaken to determine the most suitable revegetation species for the top surfaces of the TSFs. A description of the rehabilitation trials that would be undertaken for the Modification is provided in Section 3.4.

Revegetation methods for the final rock buttress cover of the TSFs may include:

- on longer slopes, spreading seed laden topsoil down slope using a dozer; and
- on steeper slopes, either pushing seed laden topsoil over the crest of the slope and/or hydromulching the slope, or mixing seed laden topsoil with rock during placement of the outermost rock buttress material.

Mixing seed through topsoil stocks would be undertaken in parallel with soil stockpile management measures (Section 3.5.2) and would involve:

- deep-ripping and applying gypsum to soil stockpiles;
- spraying a pre-emergent or post-emergent herbicide treatment to control *Lolium rigidum* (Wimmera Ryegrass);
- applying select seed mix to the treated soil surface;
- stripping the surface layer of the soil stockpile (up to approximately 1 m deep); and
- applying the seed laden topsoil to the rehabilitation area.

Evolution proposes to conduct research and implement a trial to investigate the most effective methods for revegetating the final TSF embankments and determine the species most suited to the final slopes and rehabilitation media (Section 3.4).

Revegetation methods for the final rock buttress cover would be described in detail in future MOPs which would be prepared in consultation with and subject to approval by the DRE.

3.3.5 Domain 5D – Waste Rock Emplacements

The Modification would not change the approved rehabilitation objectives for the waste rock emplacements, which are to:

- stabilise batter slopes with rock armour (primary waste rock mulch) to control surface water runoff downslope and reduce erosion potential in the long-term;
- provide a stable plant growth medium able to support long-term vegetation growth including native and/or endemic Eucalypt woodland, shrubland and grassland species suited to slope and elevated positions similar to those remnants in the surrounding landscape; and
- exclude grazing and agricultural production.

The approved final heights of the northern, southern and perimeter waste rock emplacements (308 m AHD, 283 m AHD and 233 m AHD, respectively) would remain unchanged as would the footprints of the emplacements. The Modification would however involve processing of mineralised material and would therefore remove the mineralised material stockpile as a component of the northern waste rock emplacement landform.

A conceptual cross-section of the approved northern waste rock emplacement is shown on Figure 12. The conceptual cross-section shown on Figure 12 is also representative of the concept for the southern waste rock emplacement.

Development of the emplacements would continue to be consistent with currently approved designs, and would to meet the long-term goal of directing potential seepage generated from waste rock emplacement areas toward the open pit during operation and post-closure. The waste rock emplacement batter slopes would be constructed to 1V:5H and rock armoured with primary waste rock mulch to provide long-term slope stability, control surface water runoff downslope and reduce erosion potential.

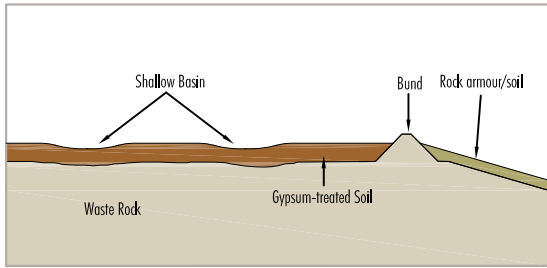
The Modification would not change the approved rehabilitation concepts for the top surfaces of the waste rock emplacements which includes managing drainage via a series of small shallow basins (depressions) and via a rehabilitation cover system that absorbs rainfall and comprises woodland vegetation (Barrick, 2013a). As described in Section 2.4.5, a layer of gypsum and then primary waste rock will be placed over oxide waste rock areas on the top surface (and batters) of the southern waste rock emplacement (which has largely been constructed of oxide waste rock material) to assist with stabilising the sodic and dispersive characteristics of the oxide waste rock material.

The use of depressions would be aimed at maximising internal drainage without creating permanent ponding during normal and heavy rainfall events (Barrick, 2013a). A bund around the perimeter of the top surfaces of the waste rock emplacement would also be constructed to provide a contained catchment and minimise surface water runoff from the top surface down the batters.

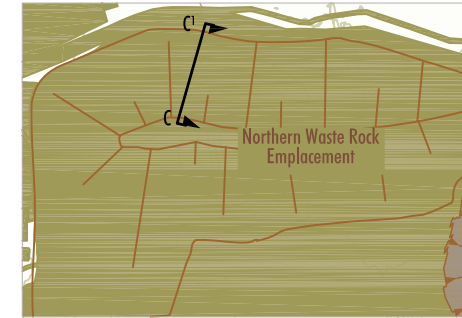
Rehabilitation Cover System – Batters

Based on the results of rehabilitation investigations and trial results to date, the rehabilitation cover system for the waste rock emplacement batters would include:

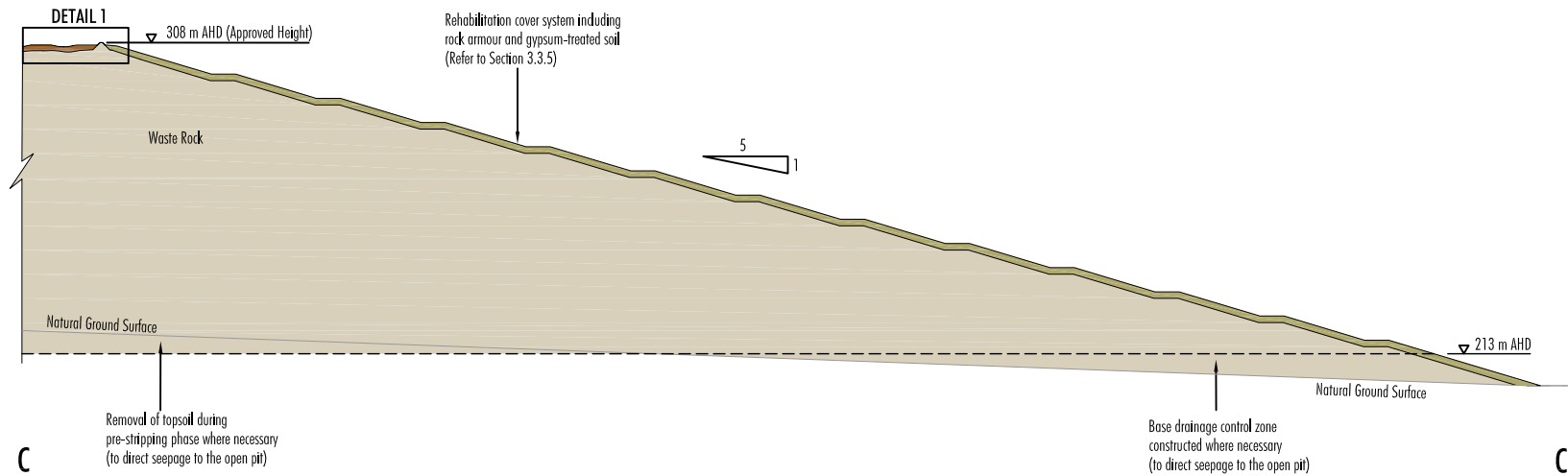
- benign (primary) rock mulch; and
- low salinity and gypsum-treated topsoil.



DETAIL 1



INSET
Refer Figure 8



HAL-6-41 ML Mod AppRA_102A



Source:

Not to Scale



CGO MINE LIFE MODIFICATION
Conceptual Embankment Section of
Approved Northern Waste Rock
Emplacement

Figure 12

The rock mulch and topsoil layers would be cross-rippled with approximately 10 t/ha gypsum, followed by seeding and/or planting with tubestock including native and/or endemic tree and shrub species during suitable seasonal conditions.

To stabilise areas where an adequate vegetation cover has yet not established, a layer (approximately 5 cm deep) of locally harvested seed bearing native pasture hay (or clean wheaten hay) would be spread to provide soil protection and soil stability for vegetation establishment. Cross-ripping along the contour of the slope is proposed to create ‘troughs and banks’ to minimise the potential for erosion downslope and enhance vegetation establishment within the troughs.

The benign (primary) rock mulch used in the cover system would be sourced from development of the open pit and would include suitable non-saline material. A description of the chemical and physical characteristics of primary waste rock is provided in Section 2.4.1.

Results of rehabilitation trials would continue to inform and refine CGO rehabilitation concepts including rehabilitation materials and revegetation species. It is expected that the northern waste rock emplacement rehabilitation trial would inform the most suitable applications (i.e. material depths) of rock mulch and topsoil and the plant species suited to the substrate materials.

Revegetation Concepts

The Modification would not change the currently approved revegetation concepts for the waste rock emplacements. Revegetation aims to re-establish endemic woodland, shrub and grassland communities similar to those remnants which persist on similar landforms in the regional landscape (e.g. Wamboyne Mountain, Fellmans Hill and Billy’s Lookout). Suitability of revegetation species would include consideration of the physiographic and hydrological features of the landform and performance relative to both stability and surface rehabilitation materials (subject to availability).

Results of rehabilitation trials, in particular the trial on the northern waste rock emplacement (Section 2.4.1), would continue to be used to determine the revegetation species suited to the cover system materials for the waste rock emplacement batters.

Revegetation species considered suitable for revegetation of the CGO waste rock emplacements have been developed by DnA Environmental (2016a) with assistance from Diversity Native Seeds (a local seed supplier) (Section 2.4.4). These species are associated with woodlands on low ridges and hills in the local landscape. A selection of these species has been used in the northern waste rock emplacement rehabilitation trial and would also be used in the large scale vegetation growth trials (Section 3.4).

Consistent with the approved Rehabilitation and Landscape Management Strategy, revegetation species lists developed for the waste rock emplacements may be refined based on the results of rehabilitation investigations and trials.

3.3.6 Domain 6D – Woodland Corridor

Consistent with the EIS (North Limited, 1998), a woodland corridor would be established between the rehabilitated northern waste rock emplacement and the rehabilitated northern TSF (Figure 5).

The rehabilitation objectives for the woodland corridor (post-operations) are to:

- establish native and/or endemic woodland species characteristic of remnant woodland communities in the surrounding landscape to provide connectivity between the rehabilitated landforms and facilitate fauna movement between the rehabilitated landforms; and
- exclude grazing and agricultural production.

3.3.7 Domain 7E – New Lake Foreshore

The Modification would not change the approved New Lake Foreshore components associated with the existing CGO (i.e. the height of the perimeter waste rock emplacement would remain unchanged and there would be no change to the temporary isolation bund or the lake protection bund). As a result, the rehabilitation concepts for the New Lake Foreshore would remain unchanged for the Modification.

A summary of the approved New Lake Foreshore rehabilitation concepts is provided below.

Rehabilitation Concepts

Similar to the design of the northern and southern waste rock emplacements, the outer batter slope of the perimeter waste rock emplacement and the temporary isolation bund would be maintained at 1V:5H. A conceptual cross-section through the lake isolation system is shown on Figure 13.

The construction of the lake isolation embankments has been completed and the temporary isolation bund and the lake protection bund have been topsoiled and revegetated with native and exotic tree and grass species including scattered aquatic species such as Lignum, Rush sp., River Cooba and River Red Gums. The outer batter slopes of the lake protection bund have been rock armoured to further protect against wave action from lake level rises.

As described in the approved rehabilitation strategy, the temporary isolation bund is a short-term feature and at the completion of operations is proposed to be reworked (breached) by light machinery (i.e. small excavator and bob cat) when the level of the lake is lower than the bund, to create a series of low mounds (Barrick, 2013a). The mounds would comprise a mixture of the inert bund rock and lakebed sediments (Barrick, 2013a).

Revegetation Concepts

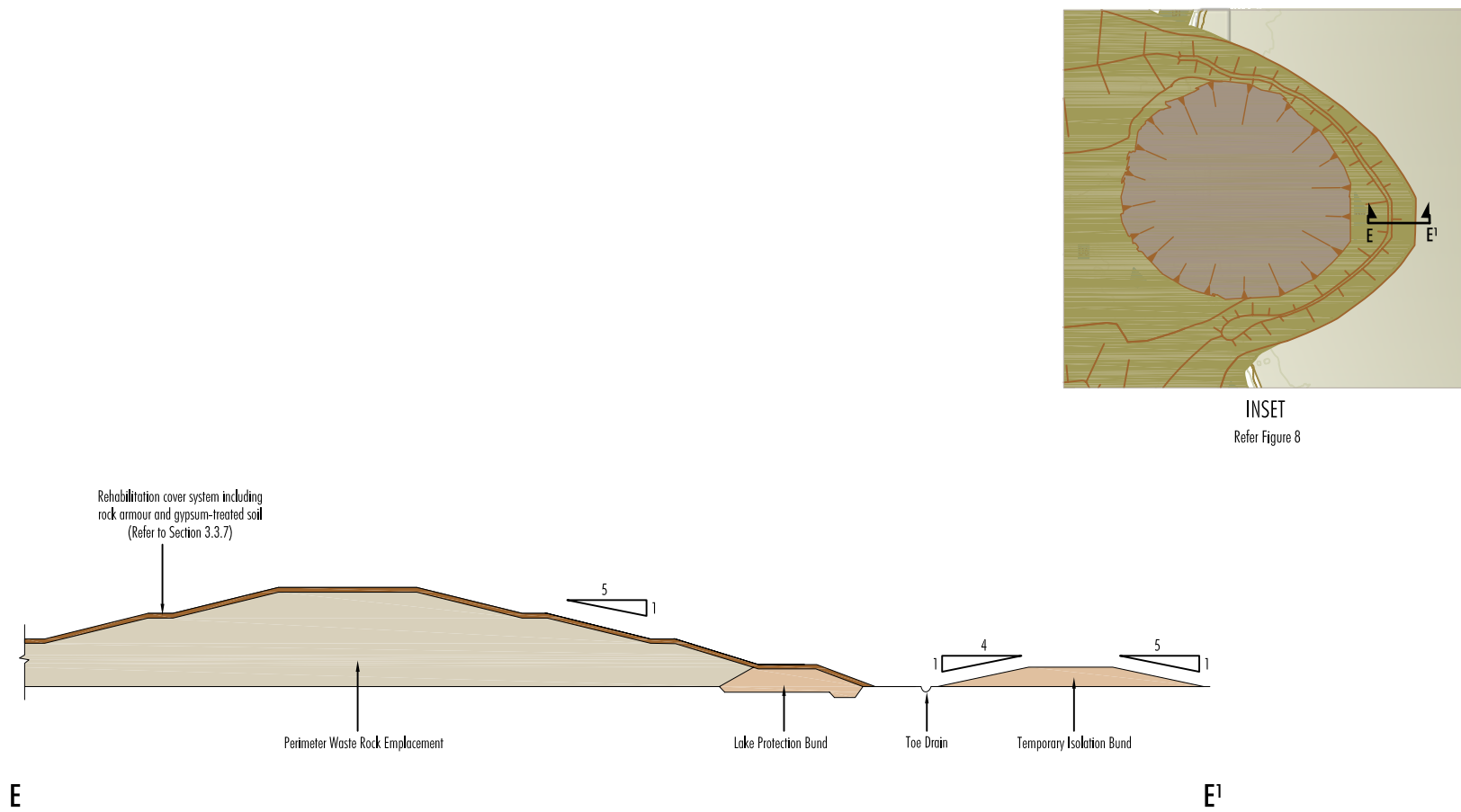
The revegetation concepts for the New Lake Foreshore would also remain unchanged for the Modification.

Rehabilitation of the New Lake Foreshore would be an iterative process and revegetation species would continue to be selected in consideration of the Lake Cowal's hydrological regime (wetting and drying cycles), species occurring in relevant reference sites (including lake and slope woodland communities), species performance during revegetation trials and suitability to substrate conditions.

Subject to these parameters, species may be selected from the following vegetative suites:

- fringing lake vegetation on the foreshore batters (i.e. Eucalypt dominated woodland including River Red Gum, River Cooba [*Acacia stenophylla*], Wilga [*Geijera parviflora*], Kurrajong [*Brachychiton populneus*], Green Wattle [*A. deanei*] and Grey Box [*E. microcarpa*]); and
- freshwater habitats (i.e. Foxtail [*Austrostipa densiflora*], Rush, Cane Grass [*Eragrostis australasica*] and Lignum).

Revegetation trials that have been undertaken on the New Lake Foreshore have included native grass establishment, hand broadcasting of Red River Gum seed and planting of wetland species such as Lignum and Rushes from tubestock and cuttings (Section 2.4.4).



Not to Scale



DnA Environmental (2016b) has observed that since 2005 there has been a significant increase in ecological function in the lake foreshore rehabilitation sites largely due to the increase in ground cover from plants which have established as a result of seed dispersal from flood events, natural regeneration from the topsoil stored seed bank as well as seed applied by hand broadcasting. DnA Environmental (2016b) note that monitoring results indicate that the two rehabilitated lake foreshore sites were ecologically functional and largely comparable to their relevant reference sites in 2015.

3.4 REHABILITATION INVESTIGATIONS AND TRIALS

Rehabilitation at the CGO would continue to be an iterative process, whereby the results of the rehabilitation trials and monitoring would continue to be used to inform and refine the rehabilitation programme in consultation with relevant regulatory agencies.

Rehabilitation trials and research proposed for the Modification would be an extension of the trials that have been undertaken to date and would include:

- **Rehabilitation Media:**
 - Northern waste rock emplacement trial – continued investigation into the effectiveness of various applications associated with the rock mulch, topsoil and hay cover materials in stabilising landform slopes (i.e. controlling erosion) and providing a suitable medium for revegetation.
- **Revegetation:**
 - Implementation of new vegetation growth trials to investigate revegetation species suited to the top surface rehabilitation materials of CGO final landforms, including the TSFs and waste rock emplacements, to refine revegetation objectives.
 - Investigations and implementation of a trial to determine the most effective methods for direct seeding rehabilitation areas following the establishment of the initial Wimmera Ryegrass cover crop.
 - Implementation of research and a revegetation trial to investigate revegetation methods and species suited to the final slopes and rehabilitation media of the final TSF embankments.

A summary of the proposed rehabilitation investigations and trials is provided below. Detailed design of the proposed trials would be provided in the revised MOP and results reported in the Annual Review.

Rehabilitation Media

As described in Section 2.4.1, a rehabilitation trial area has been established on the northern slopes of the northern waste rock emplacement to investigate the performance of various applications associated with the rock mulch, topsoil and hay cover materials. The trial includes plots assessing different topsoil depths, applications of seed bearing native pasture hay compared with clean wheaten straw hay or no hay with select native tubestock planted across all plots. Figure 6 shows a conceptual view of the design of the trial area.

Results from this trial are anticipated to inform the most effective combination of the rock mulch, topsoil and hay cover materials and inform the suitability of selected Eucalypt and Acacia revegetation species. Erosion incidence will continue to be monitored to confirm the effectiveness of the cover materials in stabilising landform slopes in the long-term.

Revegetation

Vegetation Growth Trial

Revegetation trials would continue to be undertaken for the Modification to assess the performance of select tree and shrub species in various CGO substrate materials including tailings and waste rock.

Large scale vegetation growth trials are proposed to be undertaken for the Modification to expand on the trials that have been conducted to date. The proposed vegetation growth trials would use 1 m x 1 m wide boxes, approximately 1.5 m in depth, including various topsoil, subsoil and tailings material depths and various tailings types (e.g. oxide tailings and sulphide tailings) compared with a control (topsoil only). Up to four selected species would be planted in each box (e.g. two shallow-rooted shrub species and two deep-rooted tree species).

Given the TSFs would continue to be operational and dynamic landforms, the opportunity to implement rehabilitation trials on the top surfaces of these facilities is currently unavailable. Therefore, the proposed trial boxes, placed proximal to the TSFs, would aim to replicate the top surface conditions of the TSFs.

However, as the southern waste rock emplacement would reach its final height in late 2017, the revegetation trial would be implemented on an area on the top surface of the emplacement, negating the need to use the trial boxes.

The objective of this trial would be similar to the previous vegetation growth trials (Section 2.4.4) and would assess the performance of select revegetation species in various materials associated with the TSF and waste rock emplacement top surfaces.

The trial would include gypsum-treated soils to confirm that the ameliorated soil is suitable as a plant growth medium.

Rye Grass Investigation and Trial

Based on rehabilitation monitoring results to date and the preliminary findings of the northern waste rock emplacement trial (Section 2.4.1), the annual exotic plant species Wimmera Ryegrass, present in the soil seed bank, rapidly establishes once soil is spread across CGO rehabilitation areas. This cover crop provides rapid soil surface protection and stabilises newly profiled landform slopes. Given DnA Environmental recommends direct seeding as the most effective and cost efficient revegetation method for the CGO's extensive rehabilitation areas, Evolution proposes to investigate the most effective methods for direct seeding rehabilitation areas following the establishment of the initial Wimmera Ryegrass cover crop.

The investigations are proposed to include literature reviews of rehabilitation studies and trials undertaken at other projects, and consultation with the CGO's Independent Monitoring Panel and independent rehabilitation consultant, DnA Environmental. Based on the outcome of these investigations, Evolution proposes to implement a rehabilitation trial to determine the most effective direct seeding methods and practices suited to the CGO's final landforms.

The design of the trial would be developed in consultation with DnA Environmental and the CGO's Independent Monitoring Panel and would be detailed in the revised MOP.

3.5 REHABILITATION MANAGEMENT

3.5.1 Rehabilitation Management Plan

In accordance with Development Consent Condition 2.4(c), a RMP has been developed for the CGO which details the rehabilitation management measures and rehabilitation monitoring programme currently implemented at the CGO.

The RMP would be revised (where necessary) to reflect the rehabilitation concepts for the Modification as described in Section 3.

The rehabilitation management measures detailed in the RMP would continue to apply for the Modification and would include (but not be limited to):

- progressive rehabilitation including interim rehabilitation measures;
- soil management measures including stripping procedures, soil stockpile management and soil amelioration measures;
- select revegetation species and revegetation methods;
- collection and propagation of seed for rehabilitation use;
- salvage and re-use of material for habitat enhancement on rehabilitation areas;
- erosion and sediment control measures;
- weed and pest control measures;
- exclusion of grazing and agriculture on-site;
- landscaping measures to minimise visual impacts from the CGO; and
- bushfire management measures.

A summary of the management measures listed above is provided in Section 3.5.2 below.

3.5.2 General Rehabilitation Management Measures

Progressive and Interim Rehabilitation

Consistent with Development Consent Condition 2.4(b), rehabilitation of final landforms or disturbed areas would be undertaken progressively as soon as reasonably practicable following disturbance and would include interim rehabilitation measures. Progressive rehabilitation would aim to minimise erosion and sedimentation potential and to minimise visual impacts of CGO landforms.

Interim rehabilitation measures may include:

- Rock mulch application as soon as practicable following completion of landform shaping to minimise the potential for windblown dust from waste rock surfaces and to reduce the potential for soil erosion from rainfall.
- Topsoiling and establishment of a cover crop on landform areas available for rehabilitation and on long-term soil stockpiles to minimise the area exposed for dust generation.
- Application of native pasture hay or clean wheaten hay on areas where the initial cover crop has not yet established to assist with stabilising the soil surface and minimising the loss of topsoil resources.

In addition to these measures, the safeguards and dust management controls described in the CGO's Air Quality Management Plan would be implemented to minimise dust generated from exposed areas and from general mining activities.

Soil Management Measures

The currently approved strategies/objectives for management of soil resources, as detailed in the CGO Soil Stripping Management Plan, would continue to be implemented for the Modification and would include:

- characterisation of the suitability of material for rehabilitation works prior to stripping;
- stripping and storing soil resources selectively according to their suitability for rehabilitation purposes;
- providing sufficient subsoil and stable topsoil resources for rehabilitation purposes;
- progressively rehabilitating final landforms as soon as practical once constructed to final design; and
- stripping and storing soil resources in such a manner that their long-term viability is maintained.

Soil management for the Modification would focus on ongoing soil stockpile management and soil amelioration measures, as the Modification would not involve any soil stripping.

As described in Section 3.3.4, rehabilitation materials (e.g. rock mulch and topsoil) on the existing TSF embankments would be stripped prior to buttressing of the embankments. The stripped rehabilitation materials would then be either directly transferred to a new rehabilitation area or stockpiled proximal to the TSFs for use during final rehabilitation activities.

The currently approved general protocol for management of stockpiled soils includes soil handling measures that optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth. The protocol would continue to be applied for the Modification and would include:

- leaving the surface of the completed soil stockpiles in a "rough" condition to help promote water infiltration and minimise erosion prior to vegetation establishment;
- deep ripping soil stockpiles and seeding (if necessary) to maintain soil organic matter levels, soil structure and microbial activity;
- treating soil stockpiles with gypsum to reduce dispersiveness during stockpiling;
- installing signposts for all soil stockpiles with the date of construction and type of soil; and
- recording details of all soil stockpiles on a site database which includes the location and volume of each stockpile and the stockpile maintenance records (e.g. ameliorative treatment, weed control, seeding).

Long-term topsoil stockpiles have been constructed up to approximately 3 m in height. Subsoil stockpiles vary in height as determined by storage volumes and available space within the footprint of approved disturbance areas.

Soil amelioration methods would continue to be implemented for the Modification and would be guided by the results of McKenzie Soil Management's (2013) *Soil Stockpile Characterisation Assessment*.

These methods may include:

- deep-ripping and applying gypsum (or other relevant treatments) to existing and proposed soil stockpiles;
- applying gypsum to soil during re-application on rehabilitation areas;
- spreading gypsum on the surface of original soil profiles prior to soil stripping; or
- treating strongly sodic and dispersive soil stocks with gypsum in a dedicated soil amelioration farm.

A summary of the proposed soil amelioration methods is provided below.

Treatment of Soil Stockpiles

Based on McKenzie Soil Management's (2013) recommendations, soil stockpiles would continue to be deep-ripped with gypsum (or lime, or a gypsum-lime blend) applied at the approximate rates relevant to each soil stockpile. Details of the gypsum (and other relevant treatment) application rate requirements are provided in McKenzie Soil Management's (2013) *Soil Stockpile Characterisation Assessment* which is included in the CGO's Soil Stripping Management Plan.

Based on the results of soil testing, the surface layer of the soil stockpile (up to approximately 1 m deep) would be stripped for rehabilitation use. The new surface of the stockpile would then be deep-ripped and gypsum applied (or other relevant treatment) (at a rate determined from soil testing results). This process would be repeated until all soil within the stockpile has been recovered.

As described in Section 3.3.4, once construction of the tailing storage facility embankments is complete and rehabilitation of the final rock buttress is required, seed would be applied to the relevant soil stockpiles prior to stripping the surface layer of the stockpile.

Treatment of Soil on Rehabilitation Areas

Consistent with current rehabilitation procedures at the CGO, gypsum would continue to be applied to soil used on rehabilitation areas. Based on McKenzie Soil Management's (2013) recommendations, soil re-application activities would include:

- deep-ripping the rehabilitation area surface materials (rock mulch and topsoil) to minimise compaction;
- applying coarse grade gypsum at approximately 10 t/ha to rehabilitation areas to provide a prolonged source of electrolyte to minimise dispersion of surface soils for as long as possible and to assist with the revegetation establishment; and
- applying native pasture hay where an initial vegetation cover crop has not yet established to protect the surface soil.

The rate of gypsum application may be modified based on the source/soil stockpile used.

Treatment of Original Soil Profile

McKenzie Soil Management (2013) has advised that the most effective way of ameliorating soil is by spreading gypsum on the surface of original soil profiles prior to soil stripping.

Although no additional surface disturbance is proposed for the Modification, this method would continue to be applied prior to stripping of currently approved surface disturbance areas. An average gypsum application rate of 10 t/ha/m would be used as recommended by McKenzie Soil Management (2013). Should soil sampling and testing of the area indicate the presence of suitable subsoil, gypsum would also be incorporated into the subsoil profile prior to stripping. The stripped subsoil would then be stockpiled separately. Subsoil may also be treated with gypsum while stockpiled if necessary.

Soil Amelioration Farm

McKenzie Soil Management (2013) recommended that a method for treating strongly sodic and dispersive soils would be to place these soils in a dedicated soil amelioration farm or separate soil stockpile that is deep-ripped and spread with gypsum then left over time for the gypsum to leach through the soil profile.

Based on McKenzie Soil Management's (2013) recommendations, some strongly sodic and dispersive subsoil stockpiles have been placed on the top surface of the southern waste rock emplacement. These stocks would be deep-ripped and treated with gypsum at McKenzie Soil Management's (2013) recommended application rates. Hay mulch and manure may also be applied to these stocks to improve the organic content of these soils prior to re-application on rehabilitation areas.

Soil Inventory

A detailed soil stockpile inventory would continue to be maintained to track soil resource accounting. McKenzie Soil Management's recommendations (including the treatment requirements for each soil stockpile and the soil characteristics) would be incorporated into the inventory. The inventory would be regularly updated to reflect soil treatment measures and soil usage.

Details of estimated soil resource accounting (availability and requirements for rehabilitation) would continue to be detailed in the CGO MOP.

Select Revegetation Species and Methods

A detailed description of the revegetation species and methods proposed for rehabilitation of the Modification is provided in Section 2.4.4. The RMP would be updated to reflect these species lists and proposed methods for establishment.

Collection and Propagation of Seed for Rehabilitation Use

A Vegetation Clearance Protocol (VCP) has been developed for the approved CGO and would continue to apply for the Modification. Although no additional surface disturbance is proposed for the Modification, the VCP would be implemented for areas proposed to be disturbed within currently approved disturbance areas.

During the preliminary habitat assessment phase of the VCP, trees may be examined for their provision of seed to be used in the rehabilitation programme. Where available, seed would be collected at the time of vegetation clearance activities. Seed may also be collected from surrounding vegetation on Evolution-owned lands.

Salvage and Re-use of Material for Habitat Enhancement

The VCP preliminary habitat assessment phase also identifies roosting/nesting habitat resources that may be impacted by the vegetation clearance activities. Where practicable, seed and habitat features (i.e. hollows) are salvaged for use in rehabilitation or habitat enhancement programmes within ML 1535 (and within the CGO Offset Areas).

These measures would remain unchanged for the Modification.

Erosion and Sediment Control

An Erosion and Sediment Control Management Plan (ESCMP) has been prepared and is implemented at the CGO. The ESCMP details sediment and erosion control systems developed to control the movement of sediment and salinity from areas disturbed by mining activities, and maintain downstream (Lake Cowal) water quality. These measures would remain unchanged for the Modification.

Rehabilitation monitoring at the approved CGO also includes monitoring of erosion incidence on rehabilitation areas (Section 3.6). Erosion monitoring and measures to control erosion on rehabilitation areas would continue to be undertaken for the Modification.

Weed Control

Weeds are managed at the CGO in accordance with measures described in the CGO's LMP, RMP and Biodiversity Offset Management Plan. The CGO's weed management programme is aimed at minimising the possibility of new weed incursion and controlling the spread of any existing noxious weeds on-site (including rehabilitation areas) and on all Evolution-owned land.

The weed management programme described in the LMP includes the following measures:

- identification of weeds by annual site inspections and recording weed presence in an annual weed survey report;
- communication with other landholders/leaseholders and regulatory authorities to keep weed management practices in line with regional weed control activities;
- mechanical removal of identified noxious weeds and/or the application of approved herbicides in authorised areas (herbicide use in and around wetland areas will be strictly controlled);
- implementing follow-up site inspections to determine the effectiveness of the weed control measures; and
- prevention of the establishment of new weeds on Evolution-owned land by minimising seed transport of weed species (measures may include the use of vehicle hygiene/wash down procedures for vehicles entering the offset areas [if considered necessary by the Environmental Manager or delegate]).

Rehabilitation monitoring at the CGO also evaluates floristic diversity and documents the presence of exotic plant species in the rehabilitation areas. If present, weed incursion is recorded and control measures implemented where necessary.

These measures would remain unchanged for the Modification.

Pest Control

Evolution undertakes pest control activities at the CGO in accordance with the procedures detailed in the CGO's Flora and Fauna Management Plan and the LMP. The pest control activities described in the LMP include:

- regular property inspections to assess the status of pest populations;

- mandatory pest control for declared pests (i.e. rabbits, feral pigs, wild dogs and foxes) in accordance with Pest Control Orders under the *Local Land Services Act, 2013*, and management of plague locust species including the Australian Plague Locust, Migratory Locust and the Spur-throated Locust;
- inspections to assess the effectiveness of control measures implemented and review of these measures if necessary; and
- documenting pest sightings and control measures in a Pest Register and marking the location of sightings on a map.

Evolution undertakes pest control activities in conjunction with adjacent landholders for more effective pest control. This process is facilitated via consultation with local landholders and landholder groups.

These measures would remain unchanged for the Modification.

Management of Grazing and Agriculture

In accordance with the LMP, grazing and cropping activities are excluded within ML 1535 during operation and rehabilitation of the CGO. The fence along the perimeter boundary of ML 1535 would continue to be maintained to prevent access by stock and minimise the potential for damage to rehabilitation areas.

As described in Section 3.2, rehabilitation objectives for the waste rock emplacements and TSFs involves exclusion of grazing and agricultural production from these areas post-mining. These areas would therefore be fenced post-mining.

Evolution-owned lands outside the CGO area (with the exception of RVEP Areas and Northern and Southern Offset Areas) are utilised for farming/agricultural production by Evolution and/or licensees that sign agreements to conduct agricultural activities on Evolution-owned land.

These measures would remain unchanged for the Modification.

Landscaping to Minimise Visual Impacts

Progressive rehabilitation of mine waste rock emplacements and TSFs is undertaken to reduce the contrast between the CGO landforms and the surrounding landscape. This includes progressive rehabilitation with selected grass, shrub and/or tree species.

Vegetation screens have been planted along sections of the western and northern boundaries of ML 1535 to break up continuous views from Lake Cowal Road. The vegetation screens include endemic plants that are compatible with the existing surrounding vegetation.

Maintenance of the vegetation screens (e.g. replacement of plant losses) is undertaken in these areas where necessary. An increase in screening effect over time as plants grow, would continue as a result.

These measures would remain unchanged for the Modification.

Bushfire Management

An internal Bushfire Management Plan (BMP) has been developed for the CGO that is applicable to all Evolution-owned land.

Bushfire management at the CGO includes fuel management strategies, planning and implementation procedures for hazard reduction on Evolution-owned land and strategies for reducing fire hazards and related risks.

The BMP provides a detailed description of the bushfire hazard management strategies and fuel management strategies that may be applied to Evolution-owned land.

These measures would remain unchanged for the Modification.

3.6 REHABILITATION MONITORING

The current rehabilitation monitoring methodology implemented at the CGO would be applied to the Modification. Results from the rehabilitation monitoring programme would continue to inform and refine the rehabilitation concepts for the CGO final landforms and the requirement for remedial works or rehabilitation maintenance measures (e.g. supplementary tubestock plantings to replace any losses).

A description of the current rehabilitation monitoring methodology is provided below.

Monitoring Methodology

A rehabilitation monitoring methodology has been independently developed to assess the performance of the CGO's rehabilitation areas. The same monitoring methodology is also used to assess the performance of regeneration and revegetation activities undertaken within the RVEP Areas and Northern and Southern Offset Areas (Figure 5).

The rehabilitation monitoring methodology includes a combination of (DnA Environmental, 2016b):

- LFA indicators;
- accredited soil analyses indicators; and
- an assessment of ecosystem characteristics using an adaptation of methodologies derived by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) *Methodology for the Grassy Box Woodlands Benchmarking Project in Southern NSW Murray-Darling Basin* (Gibbons, 2002) and the associated Biometric Model *Rapidly quantifying reference conditions in modified landscapes* (Gibbons *et al.*, 2008).

The methodology has been prepared in consideration of the DRE's (2013) MOP Guidelines. The methodology includes qualitative and quantitative performance indicators and completion criteria (Section 3.7) developed from relevant reference/analogue sites representative of the CGO final landforms and long-term land use strategy.

As progressive rehabilitation of completed landform features (e.g. batter slopes) occurs, additional rehabilitation monitoring sites would be included in the monitoring programme to assess the performance of the rehabilitation areas.

A summary of the monitoring methodology components is provided below.

Landscape Function Analysis

LFA is one of three components of the Ecosystem Function Analysis (EFA) tool developed by the CSIRO that aims to measure the progression of revegetation/rehabilitation towards a self-sustaining ecosystem.

LFA indices can be used to demonstrate that an area is on a trajectory towards a self-sustaining landscape, that is, the landscape contains processes operating to maintain the biogeochemical 'engine-room' of a landscape (Tongway and Hindley, 2004). The EFA methodology is described in detail in *Assessing Rehabilitation Success Version 1.1* (Tongway, 2001), *Landscape Function Analysis: Procedures for Monitoring and Assessing Landscapes with Special Reference to Minesites and Rangelands Version 3.1* (Tongway and Hindley, 2004), and *Landscape Function Analysis Field Procedures* (Tongway, 2008).

In accordance with the LFA methodology, the LFA monitoring results will be used to assess whether rehabilitation areas are on a trajectory towards a self-sustaining landscape. The relevant LFA performance indicators and completion criteria are described in Section 3.7.

Soil Analyses

Soil samples are taken using a core sampler within a monitoring quadrat at each rehabilitation monitoring site. At least 12 cores are taken at each site and soil samples sent to a National Association of Testing Authorities accredited laboratory for analysis.

Soil samples are analysed for the following parameters: pH, EC, cation exchange capacity, exchangeable sodium percentage, organic matter, available calcium, magnesium, potassium, nitrate nitrogen and sulphur, exchangeable sodium, calcium, magnesium, potassium and hydrogen, available and extractable phosphorus, micronutrients (zinc, manganese, iron, copper, boron, silicon, aluminium, molybdenum, cobalt, selenium and total carbon) and heavy metals (cadmium, lead, arsenic, chromium, nickel, mercury and silver). Exchangeable sodium percentages are calculated as a measure of sodicity or dispersion.

Ecological Assessment

In addition to LFA, various biodiversity components are assessed to monitor the successional phases/changes of plant development and to identify the requirements for ameliorative measures and guide adaptive management. The rapid ecological assessment provides quantitative data that measures changes in:

- floristic diversity including species area curves and growth forms;
- ground cover diversity and abundance;
- vegetation structure and habitat characteristics (including ground cover, cryptogams, logs, rocks, litter, projected foliage cover at various height increments);
- understorey density and growth (including established shrubs, direct seeding and tubestock plantings and tree regeneration);
- overstorey characteristics including tree density, health and survival; and
- other habitat attributes such as the presence of hollows, mistletoe and the production of buds, flowers and fruit.

Permanent transects and photo-points (as described below) have been established to record changes in these attributes over time.

The monitoring methodology described above may be revised (in consultation with relevant regulatory authorities) should an alternative method be required to adequately assess rehabilitation performance.

Monitoring Quadrats

The monitoring methodology components described above are undertaken within 20 m x 50 m monitoring quadrats established at each rehabilitation monitoring site and reference site. An LFA transect is established along the 20 m downslope boundary of the quadrat. Vegetation monitoring is undertaken within 1m x 1m subquadrats at 5 m intervals along the 50 m transect which runs perpendicular to the LFA transect.

The transects and quadrat boundary points are marked with pegs (and flagging tape) and global positioning system details recorded at each peg to ensure the location of the quadrat and transects is consistent over time.

Permanent photopoints have been established at the monitoring quadrats to monitor the changes that occur over time. The methodology for photographic monitoring is consistent with the NSW National Parks and Wildlife Service (2003) *Conservation Management Note 9 – Photographic Monitoring*. Photos are taken annually during spring and during a similar time of day (for consistence of light conditions).

The monitoring methodology described above would continue to be implemented for the Modification.

Reference Sites

The following four broad vegetation community types have been identified by DnA Environmental as representative of the CGO final landforms (DnA Environmental, 2016b):

- lake – woodlands occurring within the lake and lake foreshores (relevant to the New Lake Foreshore);
- slopes – woodlands occurring on flat to gently undulating slopes (relevant to lower slopes of the waste rock emplacements);
- hills – woodlands occurring on low ridges, hills and elevated land (relevant to upper slopes and top surfaces of the waste rock emplacements); and
- grasslands – cleared native grasslands, predominantly occurring on flat to gently undulating slopes (relevant to infrastructure areas and slopes of the TSFs [during operations]).

Reference sites relevant to each of the four broad vegetation communities listed above have been established in the landscape surrounding the CGO and include the following:

- RLake 01b and RLake 02 – woodlands occurring within the lake and lake foreshores;
- RSlope 01 and RSlope 02 – woodlands occurring on flat to gently undulating slopes;
- RHill 02, RHill 03 and RHill 06 – woodlands occurring on low ridges, hills and elevated land; and
- RGrass 01 and RGrass 03 – cleared native grasslands, predominantly occurring on flat to gently undulating slopes.

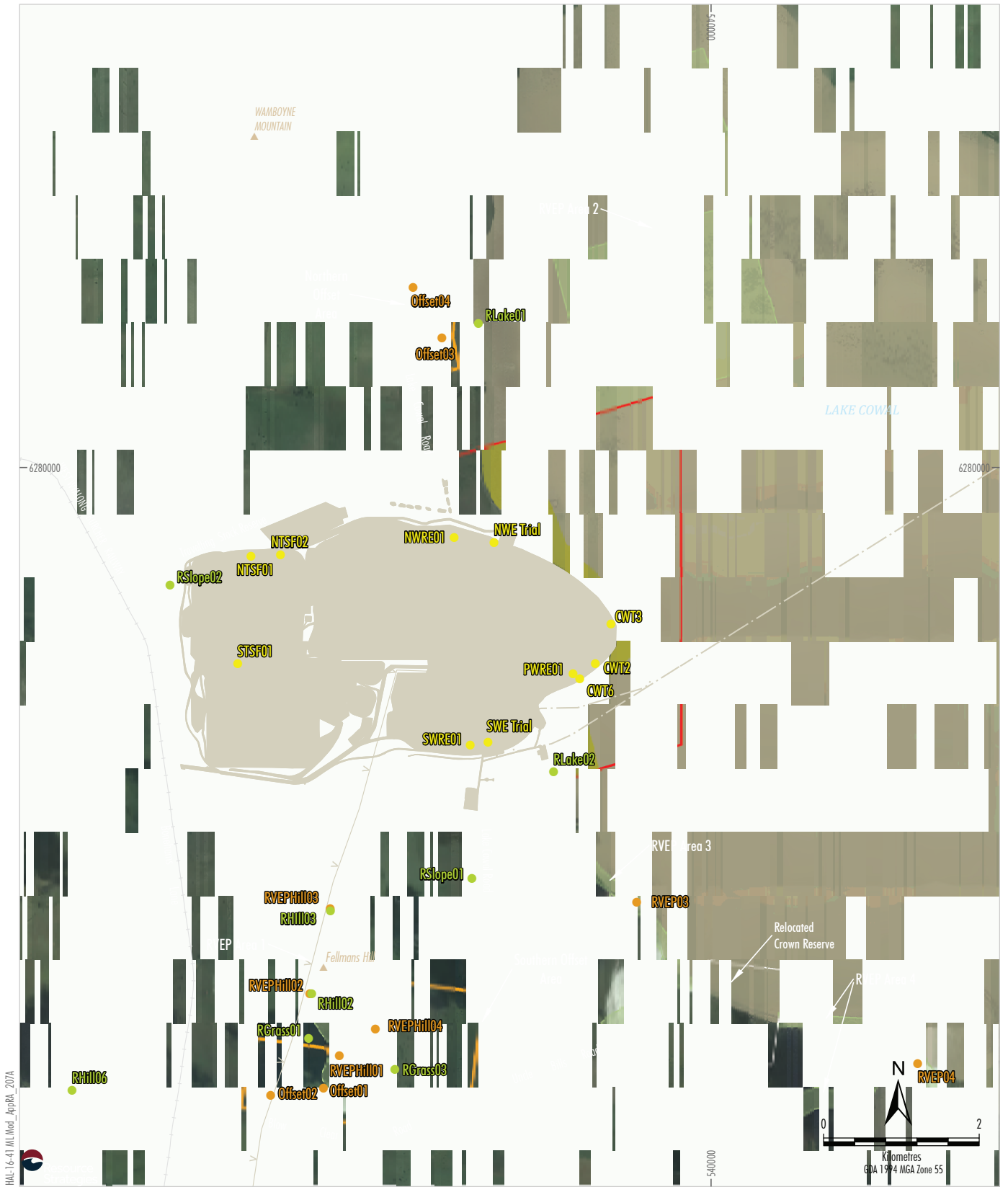
A description of the reference sites is provided in Table 5. The location of the reference sites and rehabilitation monitoring sites at the CGO are shown on Figure 14. Figure 14 also shows revegetation and/or regeneration monitoring sites located in the CGO's offset areas and RVEP areas.

Table 5
Description of Reference Sites

Reference Site ¹	Description
RLake 01b	This site is situated to the north of ML 1535 adjacent to the Northern Offset Area. It contains sparsely scattered old growth <i>E. camaldulensis</i> trees with a significant area of <i>E. camaldulensis</i> regeneration occurring in the grassy clearings. There is scattered Lignum and a variety of semi-aquatic plants. There is good ground cover and a high diversity of ground cover species, including numerous annual exotic species. In 2015 there was an increased diversity and abundance of perennial ground covers and there was increased growth and vigour of surviving shrubs.
RLake 02	This site has been monitored since 2005 as part of the CGO's Compensatory Wetland monitoring programme. This site is located on the western bank of Lake Cowal, near the southern boundary of ML 1535. It has several old growth <i>E. camaldulensis</i> and mature <i>Acacia stenophylla</i> trees including substantial regeneration of <i>A. stenophylla</i> . In 2015 there was an increased diversity and abundance of perennial ground covers and there was increased growth and vigour of surviving shrubs.
RSlope 01	This site is located in an area of the Travelling Stock Reserves south of ML 1535. The site includes regrowth <i>Acacia pendula</i> woodland situated amongst some gilgais depressions. The understorey is variable with patches of bare compacted soil, and tall scattered tussocks of <i>Austrostipa blackii</i> , <i>Atriplex semibaccata</i> , <i>Enchylaena tomentosa</i> and <i>Einadia nutans</i> are dominant, but <i>Rhodanthe corymbiflora</i> and <i>Ptilotus exaltatus</i> are common. Stockcamps are situated beneath the trees and the site is grazed intermittently by travelling stock. In 2015 there was an increased diversity and abundance of perennial ground covers and there was increased growth and vigour of surviving shrubs.
RSlope 02	This site is situated within the Wilga Woodland area in the north-western corner of ML 1535 and has been fenced off since 2004. The site is open regrowth woodland dominated by various age classes of <i>Casuarina cristata</i> and <i>A. pendula</i> , including one old growth <i>C. cristata</i> tree and some scattered <i>A. pendula</i> regeneration. Water filled gilgais are common and these are dominated by <i>Lachnagrostis filiformis</i> and <i>Eleocharis</i> species. There are bare patches surrounding the <i>A. pendula</i> saplings and various chenopods are beginning to colonise beneath the <i>C. cristata</i> trees. In 2015, macropods have further degraded the sites with little ground cover remaining.
RHill 02	Site RHill02 is located on the western side of Fellmans Hill at the transition from bushland to grassland. The site has a small stand of <i>Eucalyptus sideroxylon</i> at one end and with the remainder being open grassland with some scattered shrubs. <i>Austrostipa scabra</i> is dominant within the understorey with some bare crusted soil between the tussocks. The extent of the bare patches is declining and the shrubs have grown as the site recovers from heavy grazing pressure. In 2015 there was an increased diversity and abundance of perennial ground covers and there was increased growth and vigour of surviving shrubs.
RHill 03	This site is located on the north-west side of Fellmans Hill north of the Southern Offset Area. It is open woodland dominated by <i>E. dwyeri</i> and <i>A. doratoxylon</i> . The understorey is dominated by <i>A. densiflora</i> and <i>Gonocarpus elatus</i> but in good seasons it may contain a range of native wildflowers. The site has not been grazed since 2004 with scattered grass tussocks and a lot of leaf litter covering the ground but showed signs of extreme stress as a result of the drought up until 2010. Improved seasonal conditions in 2010 and 2011 resulted in a significant increase in the diversity and abundance of native ground cover species and improved tree health. Some small <i>A. doratoxylon</i> seedlings were recorded. In 2014 the site was heavily grazed by macropods and floristic diversity was low. In 2015 there was little significant change.
RHill06	This site is located within Grey Box woodland on the Travelling Stock Route along Blow Clear Road. First established in 2013 as a reference site, it includes open woodland with scattered mature <i>E. microcarpa</i> , <i>Callitris glaucophylla</i> and <i>Geijera parviflora</i> which are in variable health. There is scattered but sparse shrub cover which is dominated by <i>Senna artemisioides</i> along with some <i>Callitris glaucophylla</i> regeneration. The site has an excellent diversity of native grasses. The site is grazed sporadically by travelling stock. In 2014 the site was dry and floristic diversity was low.
RGrass 01	This site is situated within derived grassland in an old horse paddock immediately north of the Southern Offset Area northern boundary. It is an uncropped native grassland dominated by <i>Austrostipa nodosa</i> but Rye Grass species (<i>Lolium</i> sp.) and Haresfoot Clover (<i>Trifolium arvense</i>) are also common. There are scattered Small-leaf Bluebush (<i>Maireana microphylla</i>) and isolated occurrences of Patterson's Curse (<i>Echium plantagineum</i>). There is minimal bare ground and cryptogams are extensive, indicating positive successional recovery. . In 2014 the site was dry and floristic diversity was low. In 2015 there was little improvement and exotic annuals were common.
RGrass 03	In 2013 this site was chosen to replace site RGrass02 as it was considered more representative of the local grasslands and was the area where native grass was harvested from for use on CGO rehabilitation areas. The site is almost entirely dominated by <i>Austrostipa nodosa</i> and contains the occasional native forb and weed. In 2014 the site was dry and floristic diversity was low. In 2015 there was little improvement and exotic annuals were more common.

Source: DnA Environmental (2016b).

¹ Figure 14.



LEGEND

- Mining Lease Boundary (ML 1535)
- CGO Offset Area
- Remnant Vegetation Enhancement Programme (RVEP) Area
- Compensatory Wetland
- Currently Approved Mine Layout
- Reference Site
- Rehabilitation Monitoring Site
- Offset and RVEP Area Monitoring Site

Source: Evolution - Orthophoto (August 2016)

CGO MINE LIFE MODIFICATION
Location of Reference Sites,
Rehabilitation Monitoring Sites and
Offset and RVEP Area Monitoring Sites

Figure 14

All reference sites have been subjected to some form of former disturbance, in particular clearing and grazing and most sites have suffered some invasion from introduced species (DnA Environmental, 2016b). Despite the prior disturbance, these reference sites are typical of the local area and are considered representative of the pre-mining environment (DnA Environmental, 2016b).

Monitoring data obtained from the reference sites has been used to develop performance indicators and completion criteria values relevant to the four broad vegetation community types. Upper and lower values, or range values, have been identified by DnA Environmental to reflect seasonal conditional and disturbance events which are amended annually. A description of the current performance indicators and completion criteria is provided in Section 3.7 below.

3.7 PERFORMANCE INDICATORS AND COMPLETION CRITERIA

As a component of DnA Environmental's rehabilitation monitoring methodology, a detailed set of performance indicators and completion criteria has been developed to assess rehabilitation performance at the CGO.

The performance indicators and completion criteria reflect the 'rehabilitation phases' (at which ecological targets are relevant) defined in the DRE's (2013) MOP Guidelines:

- landform establishment;
- growth medium development;
- ecosystem and land use establishment; and
- ecosystem and land use development.

Table 6 outlines the rehabilitation performance indicators and completion criteria which have been developed by DnA Environmental (2016b) to assess rehabilitation performance at the CGO.

DnA Environmental has identified an upper and lower range of criteria values based on the monitoring data collected across the reference sites. It is important to note that these upper and lower criteria values are dynamic and change each year based on the monitoring results from the reference sites. This is undertaken to reflect the seasonal and climatic conditions at the time of monitoring.

Rehabilitation performance at the CGO will be considered to be satisfactory when the monitoring data indicates the completion criteria have been met, or when the relevant Minister(s) otherwise accepts the rehabilitation status.

**Table 6
Rehabilitation Performance Indicators and Completion Criteria**

Rehabilitation Phase	Aspect or Ecosystem Component	Completion Criteria	Performance Indicators	Unit of Measurement	Lake Foreshore Ecosystem Range 2015		Grassland Ecosystem Range 2015		Hill Ecosystem Range 2015		Slopes Ecosystem Range 2015		
					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	
<i>Performance indicators are quantified by the range of values obtained from replicated reference sites</i>					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	
Landform establishment	Landform slope, gradient	Landform suitable for final land use and generally compatible with surrounding topography	Slope	Degrees	1	5	4	6	2	7	1	4	
	Active erosion	Areas of active erosion are limited	Number of rills/gullies	Number	0	0	0	0	0	0	0	0	
			Cross-sectional area of rills/gullies	m ²	0	0	0	0	0	0	0	0	
Growth medium development	Soil chemical, physical properties and amelioration	Soil properties are suitable for the establishment and maintenance of selected vegetation species	pH	pH	6.65	6.80	5.8	6.0	4.4	5.8	7.73	8.13	
			EC	<dS/m	0.047	0.082	0.047	0.068	0.060	0.093	0.263	0.653	
			Organic Matter	%	1.8	1.8	3.0	3.7	5.0	22.4	2.7	2.9	
			Phosphorous	ppm	11.5	26.0	7.7	19.2	8.0	24.2	8.3	16.5	
			Nitrate	ppm	2.2	2.9	3.7	4.8	4.3	10.1	3.2	4.2	
			Cation Exchange Capacity	Cmol+/kg	7.4	20.3	9.0	9.7	9.4	10.7	29.3	35.0	
Ecosystem and Land Use Establishment	LFA Landform Stability and Landscape Organisation indices	Landform is stable and performing as was designed to do	LFA Stability	%	58.7	78.0	70.5	71.0	65.5	65.9	51.2	67.0	
			LFA Landscape Organisation	%	84	100	100	100	89	100	4	100	
	Vegetation diversity	Vegetation contains a diversity of species comparable to that of the local remnant vegetation	Diversity of shrubs and juvenile trees	Species/area		4	5	0	1	1	3	2	3
				% population		100	100	0	100	100	100	92	100
			Total species richness	Number/area	38	50	32	42	12	54	37	40	
			Native species richness	>Number/area	24	40	26	28	11	48	30	36	
	Exotic species richness	<Number/area	10	14	6	14	1	8	4	7			
	Vegetation density	Vegetation contains a density of species comparable to that of the local remnant vegetation	Density of shrubs and juvenile trees	Number/area	167	220	0	1	36	58	38	57	

Table 6 (continued)
Rehabilitation Performance Indicators and Completion Criteria

Rehabilitation Phase	Aspect or Ecosystem Component	Completion Criteria	Performance Indicators	Unit of Measurement	Lake Foreshore Ecosystem Range 2015		Grassland Ecosystem Range 2015		Hill Ecosystem Range 2015		Slopes Ecosystem Range 2015	
					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
<i>Performance indicators are quantified by the range of values obtained from replicated reference sites</i>					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Ecosystem and Land Use Establishment (Cont.)	Ecosystem composition	The vegetation is comprised by a range of growth forms comparable to that of the local remnant vegetation	Trees	Number/area	1	1	0	1	1	4	0	2
			Shrubs	Number/area	3	4	0	0	1	2	1	2
			Sub-shrubs	Number/area	2	4	1	6	0	8	7	8
			Herbs	Number/area	19	26	19	25	6	24	16	17
			Grasses	Number/area	12	13	10	10	2	16	8	12
			Reeds	Number/area	1	2	0	0	0	1	1	2
			Ferns	Number/area	0	0	1	1	1	1	0	1
			Aquatic	Number/area	0	0	0	0	0	0	0	0
Ecosystem and Land Use Development	LFA Landform Function and Ecological Performance indices	Landform is ecologically functional and indicative of a landscape on a trajectory towards a self-sustaining ecosystem	LFA Infiltration	%	48.7	52.1	36.6	45.0	33.7	53.0	23.9	34.7
			LFA Nutrient Cycling	%	36.9	51.3	36.5	45.5	34.4	47.4	20.3	37.6
	Protective ground cover	Ground layer contains protective ground cover and habitat structure comparable with the local remnant vegetation	Litter cover	%	56	66	71	83	59	79	28	44
			Annual plants	<%	1	3	3	3	0	1	0	0
			Cryptogam cover	%	1	2	0	3	1	9	13	23
			Rock	%	0	0	1	1	0	3	0	0
			Log	%	0	0	0	0	0	10	0	3
			Bare ground	<%	9	10	0	3	1	12	12	39
			Perennial plant cover (< 0.5m)	%	25	29	9	27	1	32	18	22
	Total Ground Cover	%	90	92	97	100	89	100	61	88		
	Ground cover diversity	Vegetation contains a diversity of species per square meter comparable to that of the local remnant vegetation	Native understorey abundance	> species/m ²	3	5	5	6	2	6	4	7
Exotic understorey abundance			< species/m ²	1	2	2	2	0	1	0	1	

Table 6 (continued)
Rehabilitation Performance Indicators and Completion Criteria

Rehabilitation Phase	Aspect or Ecosystem Component	Completion Criteria	Performance Indicators	Unit of Measurement	Lake Foreshore Ecosystem Range 2015		Grassland Ecosystem Range 2015		Hill Ecosystem Range 2015		Slopes Ecosystem Range 2015	
					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
<i>Performance indicators are quantified by the range of values obtained from replicated reference sites</i>					Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Ecosystem and Land Use Development (Cont.)	Native ground cover abundance	Native ground cover abundance is comparable to that of the local remnant vegetation	Percent ground cover provided by native vegetation <0.5m tall	%	68.2	83.3	67	76	82.1	100	80.5	98.3
	Ecosystem growth and natural recruitment	The vegetation is maturing and/or natural recruitment is occurring at rates similar to those of the local remnant vegetation	shrubs and juvenile trees 0 - 0.5m in height	No./area	32	56	0	1	1	18	6	8
			shrubs and juvenile trees 0.5 - 1m in height	No./area	59	80	0	0	0	23	5	9
			shrubs and juvenile trees 1 - 1.5m in height	No./area	28	66	0	0	0	7	7	9
			shrubs and juvenile trees 1.5 - 2m in height	No./area	14	28	0	0	0	4	1	11
			shrubs and juvenile trees >2m in height	No./area	10	14	0	0	0	53	17	22
	Ecosystem structure	The vegetation is developing in structure and complexity comparable to that of the local remnant vegetation	Foliage cover 0.5 - 2 m	% cover	2	3	0	2	5	13	5	16
			Foliage cover 2 - 4m	% cover	0	0	0	0	0	14	3	8
			Foliage cover 4 - 6m	% cover	0	3	0	0	0	14	0	3
			Foliage cover >6m	% cover	0	12	0	0	3	29	0	11
	Tree diversity	Vegetation contains a diversity of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree diversity	species/area	1	2	0	0	2	5	1	2
				%	100	100	0	0	100	100	100	100
	Tree density	Vegetation contains a density of maturing tree and shrubs species comparable to that of the local remnant vegetation	Tree density	No./area	1	12	0	0	6	50	5	18
				Average dbh	cm	24	94	0	0	11	50	13
	Ecosystem health	The vegetation is in a condition comparable to that of the local remnant vegetation	Live trees	% population	100	100	0	0	57	100	80	83
			Healthy trees	% population	0	50	0	0	6	83	0	56
			Medium health	% population	42	100	0	0	17	72	28	60
Advanced dieback			% population	0	8	0	0	0	7	0	20	
Dead Trees			% population	0	0	0	0	0	43	17	20	
Mistletoe			% population	0	0	0	0	0	0	0	20	
Flowers/fruit: Trees			% population	0	0	0	0	10	83	0	0	
Hollows: Trees	% population	0	100	0	0	0	33	0	11			

Source: DnA Environmental (2016b).

Ongoing Evaluation of Rehabilitation

A monitoring data analysis, assessment and review process is implemented at the CGO and is detailed in the RMP.

Rehabilitation monitoring data is used to:

- track revegetation and/or regeneration progress against performance indicators and completion criteria;
- assess the performance of landform design and rehabilitation concepts and methods;
- evaluate the effectiveness of environmental management measures/controls; and
- identify the requirement for intervention strategies or ameliorative/contingency measures.

The results of rehabilitation monitoring, rehabilitation trials and investigations are used to inform and refine future rehabilitation activities at the CGO. These results are reported in the CGO Annual Review. Rehabilitation planning (including proposed rehabilitation concepts, activities and scheduling) is undertaken via the MOP which is prepared in consultation with and is subject to approval by the DRE.

In addition to the above, in accordance with the CGO's Development Consent (DA 14/98), rehabilitation (and overall environmental) performance at the CGO is independently assessed via the Independent Environmental Audit process and the Independent Monitoring Panel inspection and review process. Results of these processes including the CGO's Annual Review are reported quarterly to the CGO's Community Environmental Monitoring and Consultative Committee.

These measures would remain unchanged for the Modification.

4 MINE CLOSURE AND LEASE RELINQUISHMENT

Upon cessation of mining operations, tenure of ML 1535 would be maintained by Evolution until such a time when lease relinquishment criteria have been met and the relevant Minister(s) accepts the rehabilitation status of the site. It is anticipated that lease relinquishment criteria would include:

- Rehabilitated landforms are stable and consistent with the nominated post-mining land use which has been developed in consultation with relevant regulatory agencies and key stakeholders.
- The water quality of Lake Cowal has not been detrimentally affected by the final landforms.
- Rehabilitated final landforms are indicative of a landscape on a trajectory towards a self-sustaining ecosystem and comprise self-sustaining native and/or endemic species characteristic of remnant vegetation communities in the surrounding landscape.
- All ML 1535 conditions (including public safety considerations) and Development Consent conditions have been satisfied.
- Hard-stand areas and infrastructure have been removed (unless otherwise agreed with the ultimate landholder).

The *Strategic Framework for Mine Closure* published by the Australian and New Zealand Minerals and Energy Council and Mineral Resources Council of Australia (2000) would be used as a guide for mine closure.

Mine closure concepts and management measures will continue to be developed via the MOP in consultation with the DRE and other relevant regulatory agencies.

Mine Workforce Phase Out Plan

As required by Development Consent Condition 9.1(d)(iii), at least four years prior to mine closure, a Mine Workforce Phase Out Plan will be developed in consultation with the CEMCC. The Plan would identify and describe post-mining issues, particularly in relation to reduced employment and the consequent impacts on West Wyalong.

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