



**SECTION 4**  
Environmental Assessment

**COWAL GOLD OPERATIONS  
PROCESSING RATE MODIFICATION**

Environmental Assessment  
2018



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## 4 ENVIRONMENTAL ASSESSMENT

### 4.1 HYDROGEOLOGY

The Hydrogeological Assessment for the Modification was conducted by Coffey Services Australia Pty Ltd (Coffey) (2018) and is presented in Appendix A. The report is separated into two assessments for the mine site and borefields respectively, to address the hydrogeological effects of the Modification including:

1. changes to mining activities within ML 1535 (i.e. addition of the IWL, continued open pit dewatering and use of the mining lease saline bores); and
2. continued operation of the off-site Bland Creek Palaeochannel Borefield and Eastern Saline Borefield for water supply.

The Hydrogeological Assessment (Coffey, 2018) and Hydrological Assessment (prepared by HEC [2018] [Appendix B]) have been conducted in an integrated manner (e.g. predicted groundwater inflow to the open pit has been included in the Hydrological Assessment's site water balance).

A description of the existing groundwater environment relevant to the CGO is provided in Section 4.1.1. Section 4.1.2 describes the potential impacts of the Modification on groundwater. Section 4.1.3 outlines the mitigation and management measures relevant to groundwater proposed for the Modification.

#### 4.1.1 Existing Environment

##### **Baseline Groundwater Data**

A significant number of hydrogeological studies and site testwork have been conducted for the CGO area and surrounds, including:

- *Lake Cowal Project – Laboratory Testing of Tailings* (Knight Piesold Pty Ltd, 1994);
- *Lake Cowal Project Hydrogeological Modelling and Dewatering Study* (Coffey Partners International Pty Ltd [Coffey Partners International], 1995);
- the EIS, which included the groundwater studies *Hydrogeological Assessment of Lake Cowal Project Water Management Review* (Coffey Partners International, 1997) and *Groundwater Studies – Pre-assessment Groundwater Issues* (Kalf and Associates Pty Ltd, 1997);

- *Cowal Northern Tailings Storage Facility – Floor Permeability* (URS Australia Pty Limited, 2005);
- *Cowal Southern Tailings Storage Facility – Floor Permeability* (URS Australia Pty Limited, 2006);
- *Cowal Gold Project – Preliminary Hydrogeochemical Review of the Groundwater System* (Parsons Brinckerhoff Australia Pty Ltd, 2007);
- *Cowal Gold Mine E42 Modification Hydrogeological and Tailings Seepage Assessment* (Coffey Geotechnics Pty Ltd [Coffey Geotechnics], 2008);
- *Cowal Gold Mine – Groundwater Level Investigation* (Coffey Geotechnics, 2009a);
- *Cowal Gold Mine – E42 Modification Modified Request Environmental Assessment* (Coffey Geotechnics, 2009b);
- *Hydrogeological Assessment – Cowal Gold Mine Extension Modification* (Coffey Geotechnics, 2013);
- *Groundwater Investigation – Progressive Groundwater Level Rise in MON02A and MON02B* (Northern Resource Consultants, 2016); and
- *Hydrogeological Assessment – Cowal Gold Operations Mine Life Modification* (Coffey, 2016).

A comprehensive review of existing geological and hydrogeological information, as well as relevant monitoring data and mapping, was undertaken by Coffey (2018) (Appendix A), including evaluation of the following:

- previous hydrogeological investigations (listed above);
- data collected from the existing CGO groundwater monitoring network in accordance with the existing WMP and SWGMBMP;
- available information on local water bores and groundwater usage in the vicinity of the CGO, including DI-Water monitoring bores;
- publicly available regional geological data;
- detailed local geological data held by Evolution; and
- geographic information including aerial photography, satellite imagery, digital elevation models, geophysical, cadastral and hydrological data sets.

Existing groundwater monitoring locations, including for the Bland Creek Palaeochannel, are shown on Figure 2-3 and Figure 4-1.

The Hydrogeological Assessment has considered the requirements of relevant Water Sharing Plans listed under the NSW *Water Management Act, 2000*.

### **Existing Groundwater Regime**

The Water Sharing Plans relevant to the CGO include the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012* and the *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011*. The *Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011* was amended on 5 July 2013, however these changes to the Water Sharing Plan do not affect the pre-existing licensing arrangements at the CGO.

The conceptual groundwater model of the existing groundwater regime in the region developed by Coffey (2018) supports the two groundwater systems identified in the relevant Water Sharing Plans, which are as follows:

- alluvial groundwater system; and
- fractured rock groundwater system

#### *Alluvial Groundwater System*

Alluvial groundwater resources within the region are generally associated with two geological formations (Appendix A):

- the Cowra Formation (i.e. Eastern Saline Borefield and supply bores within ML 1535), which comprises aquifers of isolated sand and gravel lenses in predominantly silt and clay alluvial deposits, with perched groundwater of generally higher salinity; and
- the Lachlan Formation (i.e. Bland Creek Palaeochannel), which comprises an aquifer of quartz gravel with groundwater of generally low salinity.

The existing CGO open pit intersects the Cowra Formation, but does not intersect the Lachlan Formation (Figure 4-2). The saline groundwater supply bores within ML 1535 extract water from the Cowra Formation. The Bland Creek Palaeochannel Borefield extracts water from the Lachlan Formation, while the Eastern Saline Borefield extracts water from the Cowra Formation.

#### *Fractured Rock Groundwater System*

The fractured rock groundwater system underlies the alluvial groundwater system, and consists of the following geological formations:

- the Ordovician aged Lake Cowal Volcanics Complex, which comprise massive and stratified non-welded pyroclastic debris, overlying a partly brecciated lava sequence, overlying volcanic conglomerate interbedded with siltstone and mudstone; and
- overlying Siluro-Devonian Group and Ootha Formation, which comprise shallow to deep marine sedimentary units.

The existing CGO open pit intersects the Lake Cowal Volcanics Complex.

### **Existing Effects of Mining Activities at the Cowal Gold Operations**

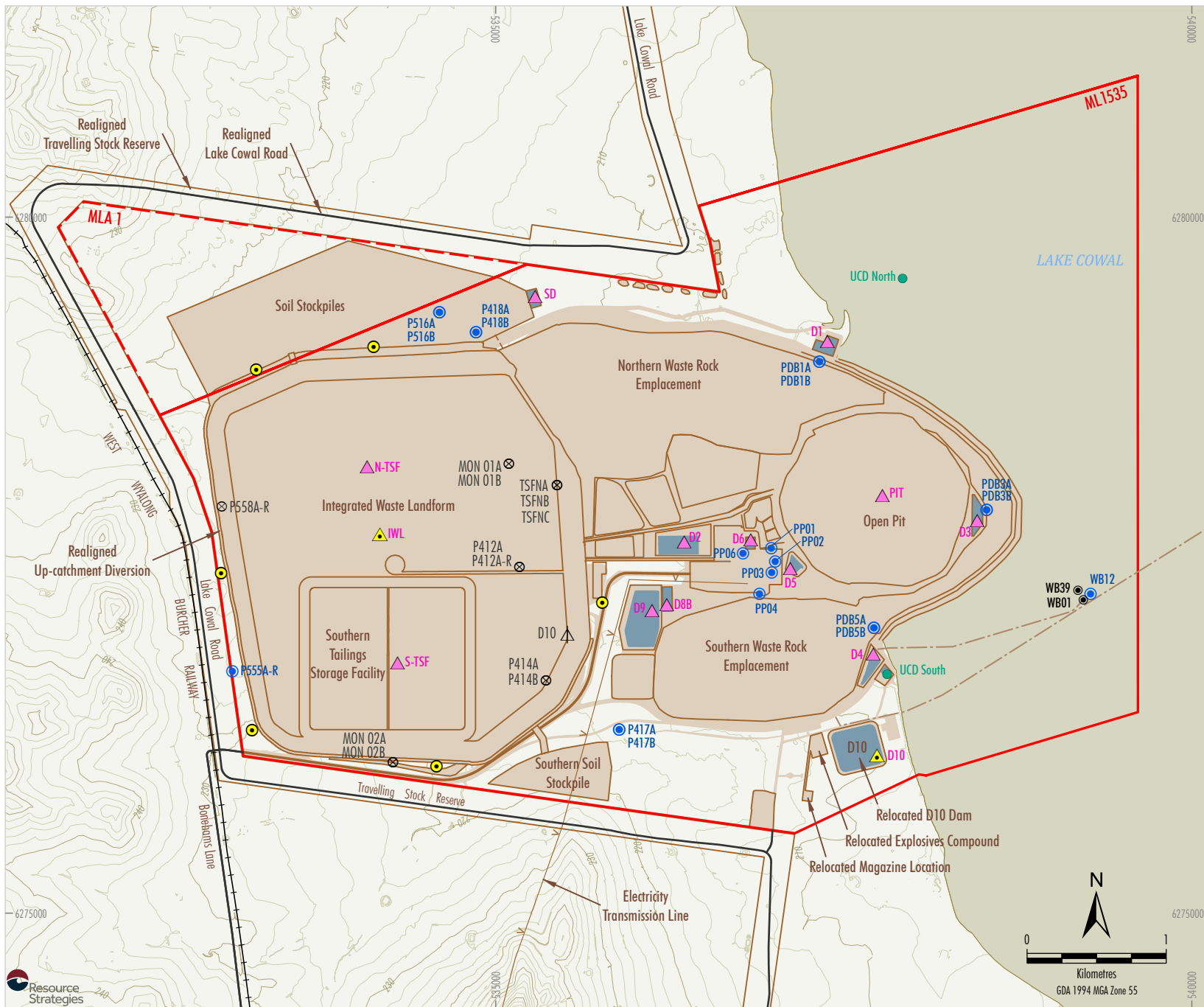
#### *Groundwater Inflows to the Open Pit and Open Pit Dewatering*

Groundwater inflow to the open pit is managed by in-pit sumps (which also collect incidental rainfall). Horizontal drains in the pit wall accelerate depressurisation of the aquifer system by draining groundwater into the pit sumps.

Prior to 2018, groundwater inflow to the open pit was also managed by a ring of vertical dewatering bores around the open pit, which were progressively decommissioned as it was demonstrated the horizontal drains successfully depressurise the pit wall (i.e. without the need for vertical dewatering bores).

Current groundwater inflow to the open pit is estimated to be approximately 159 ML/annum, with approximately 10% of groundwater inflows from the alluvial groundwater system and 90% of groundwater inflows from the fractured rock groundwater system (Appendix A).

Groundwater inflow to the open pit is estimated to have generally decreased since 2008 as the adjacent aquifers surrounding the CGO open pit have become depressurised. No material increase in groundwater inflow to the open pit occurred during and following the 2010, 2012 or the most recent 2016 lake-fill events; based on monitored pit dewatering records (Appendix A).

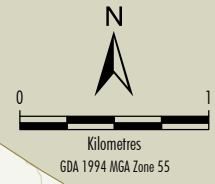


- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application Boundary (MLA 1)
  - Approximate Extent of Surface Development
  - Contained Water Storage
  - CGO Production Bore
  - ⊙ Groundwater Level and Quality Monitoring Bore
  - ⊗ Groundwater Level and Quality Monitoring Bore Decommissioned due to IWL
  - ⊙ Indicative Replacement Groundwater Level and Quality Monitoring Bore
  - ▲ Surface Water Quality Monitoring Site
  - △ Removed Surface Water Quality Monitoring Site
  - ▲ Indicative New Surface Water Quality Monitoring Site
  - Up-catchment Drainage Monitoring Site

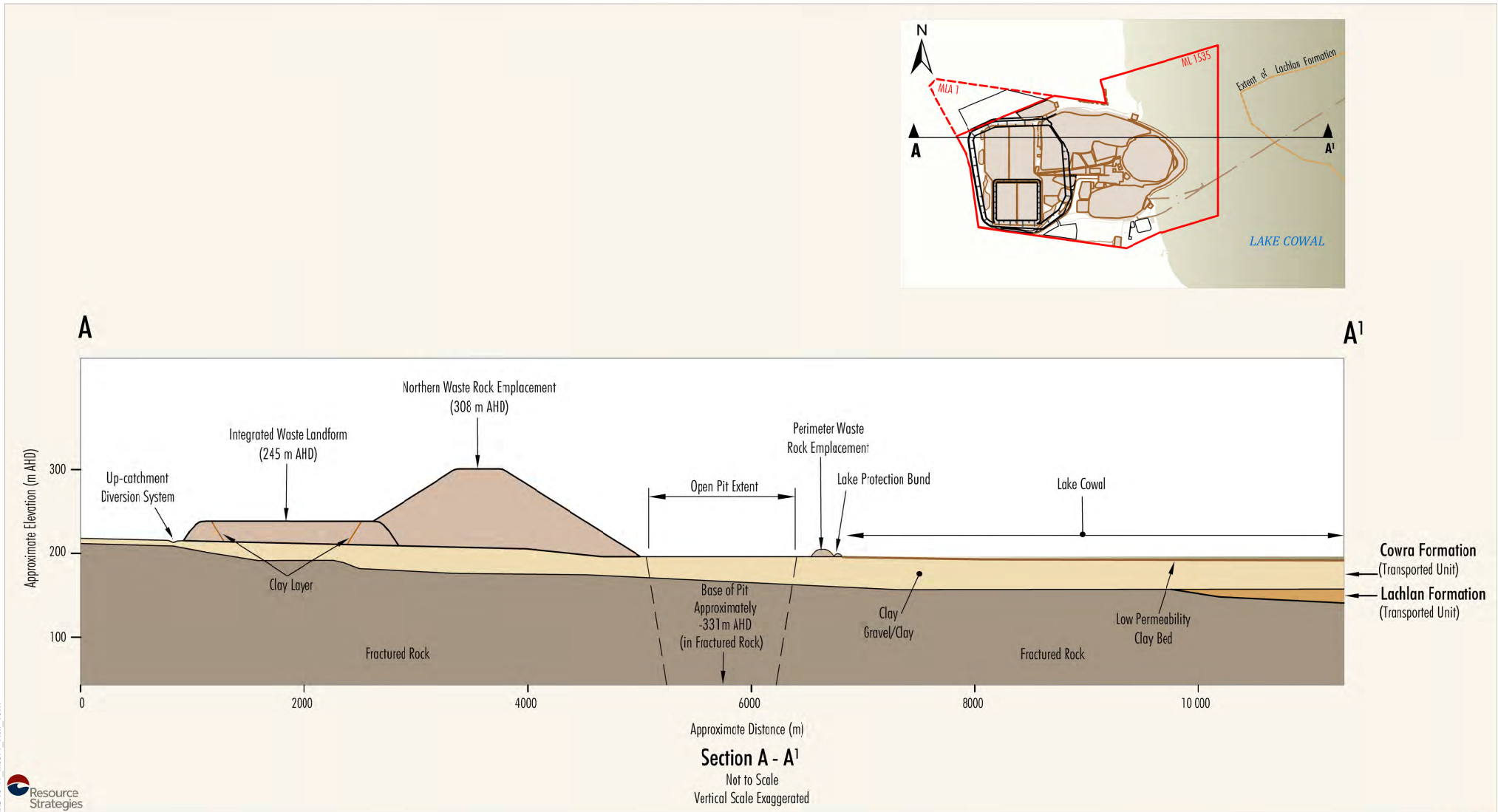
Source: Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**ML 1535**  
**Groundwater and**  
**Surface Water Monitoring Locations**



**Figure 4-1**



HAL-16-41 Mod14 PRM 109A



- LEGEND**
- Host units for the Lachlan Unregulated and Alluvial Water Sources
  - Host units for the NSW Murray Darling Basin Fractured Rock Groundwater Sources

Source: Evolution (2018); Coffey (2016)



CGO PROCESSING RATE MODIFICATION  
Conceptual Hydrogeological  
Cross-section across Mine Site

Figure 4-2

**Measured Groundwater Water Level Drawdown**

Within ML 1535, monitoring data (Appendix A) shows some drawdown in the Cowra Formation due to groundwater inflow to the CGO open pit. The monitoring data indicates that this drawdown is localised, and is considered to have not significantly affected groundwater levels in the Cowra Formation or Lachlan Formation outside of ML 1535.

**Hydraulic Relationship between Lake Cowal and Groundwater Systems**

Previous studies indicated that Lake Cowal is hydraulically separated from the underlying aquifers, due to the very low permeability of the clay pan deposits that form the lake bed. Based on this, it was predicted there would be very low potential for significant quantities of water to infiltrate from Lake Cowal to the underlying aquifers (i.e. associated with the Cowra Formation).

Monitoring data collected since the 2010, 2012 and 2016 lake-fill events indicates no increase in groundwater inflow to the open pit has occurred, which supports the predictions of previous assessments regarding the hydraulic separation of Lake Cowal from the underlying aquifers (Appendix A). Further, monitoring data indicates that inflow to the open pit has generally been lower during lake-fill conditions (2010 onwards) compared with when the lake was dry (Appendix A).

**Existing Management of Groundwater Levels in the Bland Creek Palaeochannel**

Groundwater levels in the Bland Creek Palaeochannel are managed in accordance with the existing Groundwater Contingency Strategy, which involves the monitoring of groundwater levels, and the implementation of response measures should groundwater levels reach trigger levels developed in consultation with DI-Water and other groundwater users (Section 2.8.3).

The trigger levels are as follows:

- Bore GW036553 (Bland Creek Palaeochannel Borefield area) – trigger levels of 137.5 m AHD and 134 m AHD.
- Bore GW036597 (Billabong area) – trigger level 145.8 m AHD.
- Bore GW036611 (Maslin area) – trigger level 143.7 m AHD.

Investigation and mitigation contingency measures have been developed should groundwater levels reach either 137.5 m AHD (trigger for investigation) or 134 m AHD (trigger for mitigation) in the monitoring bore closest to Evolution's Bland Creek Palaeochannel Borefield (i.e. GW036553).

In the event that the groundwater level in Bore GW036553 is below 137.5 m AHD, one or more of the following contingency measures will be implemented in consultation with DI-Water:

- investigate the groundwater level in the Trigalana Bore (GW702286) and any other impacted stock and domestic bores;
- determine the pump setting in relevant stock and domestic bores;
- determine the drawdown rate in Bore GW702286 and other impacted stock and domestic bores;
- develop an impact mitigation plan for impacted stock and domestic bores; and/or
- set up an alternative water supply for the owner of Bore GW702286 and other owners of impacted stock and domestic bores, if necessary.

In the event that the groundwater level in Bore GW036553 is below 134 m AHD, one or both of the following contingency measures will be implemented in consultation with DI-Water:

- alter the pumping regime of the Bland Creek Palaeochannel Borefield to maintain the water level in impacted stock and domestic bores; and
- maintain a water supply to the owner/s of impacted stock and domestic bores.

To date, the effect of the Groundwater Contingency Strategy is that pumping from the Bland Creek Palaeochannel Borefield ceases when required to meet the trigger levels described above, and water requirements at the CGO are met by alternative internal or external water supplies, including Lachlan River water entitlements (Section 2.8.4).

It is noted that groundwater levels at Bore GW036597 (Billabong area) and Bore GW036611 (Maslin area), which are located some 15 km to the south of the Bland Creek Palaeochannel Borefield, are largely influenced by groundwater use by users other than Evolution (e.g. for irrigation).



## **Tailings Storage Facility and Integrated Waste Landform Seepage**

### *Floor Permeability*

A number of seepage control measures have been incorporated into the design and operation of the existing TSFs at the CGO, with any potential residual seepage from the TSFs directed towards the open pit (Section 3.6).

URS Australia Pty Limited (2005; 2006) conducted field investigations and laboratory testing for both the NTSF and STSF, concluding:

- Investigations consistently showed the uppermost 5 m of the TSF footprints to be essentially clay soils of extremely low permeability.
- Laboratory testing of typical samples from within 5 m of floor level yielded permeabilities less than the target permeability of  $1 \times 10^{-9}$  m/s (i.e.  $9 \times 10^{-5}$  metres per day).
- Inspections of cut-off trench excavation and storage floor did not reveal any continuous zones or lenses of high permeability soil that might provide a preferential leakage path.

AECOM (AECOM, 2017) conducted additional geotechnical site investigations (consisting of boreholes, test pit excavations and cone penetration testing) for the existing TSFs, as well as investigations in the area of the proposed IWL footprint (CMW Geosciences, 2018). The geotechnical investigations concluded that the IWL foundation conditions generally comprise of clayey topsoil overlying stiff to hard clay (CMW Geosciences, 2018).

### *Groundwater Levels*

Groundwater monitoring (e.g. at monitoring bores MON02A and MON02B) (Figure 4-1) indicates that groundwater levels in the vicinity of the existing TSFs show a gradual rise since the commencement of tailings deposition at the CGO (Appendix A).

Assessment indicates that this gradual rise in groundwater levels is related to the percolation and movement of seepage from the TSFs (Northern Resource Consultants, 2016). A description of potential impacts associated with rising groundwater levels due to tailings seepage, and associated contingency measures, is provided in Sections 4.1.2 and 4.1.3.

### *Solute Transport*

Seepage parameters were used in previous assessments to predict potential solute transport from the TSFs (Appendix A).

Due to the low permeability and retardation (i.e. due to sorption processes) of the geological layers surrounding the TSFs, it was predicted solute transport from seepage from the TSFs would not extend beyond a distance of approximately 200 m from the TSFs, and in the long-term, cyanide would degrade in the tailings storage and surface of the underlying aquitard and would be effectively removed from the subsurface (Appendix A).

Based on CGO groundwater monitoring results analysed up to August 2017, cyanide has not been observed at significant concentrations (i.e. has generally been below detection limits) in groundwater samples from bores surrounding the TSFs (Appendix A).

Where monitoring has shown total cyanide to be present, its concentration at individual monitoring locations has not been consistent over time, and there is no consistent trend to suggest that significant concentrations of cyanide have leached from the TSFs into the surrounding groundwater (Appendix A).

### **Other Groundwater Users**

Evolution is the only known user of the saline alluvial aquifers that immediately surround the CGO mining operations.

In the region, there is reliance upon groundwater bores as a source of water for agricultural enterprises and other uses. The majority of the privately-owned pumping bores in the area are within the Lachlan Formation with a small number in the Cowra Formation (Appendix A). No privately-owned bores have been identified in the fractured rock groundwater system surrounding the CGO (Appendix A).

### **Groundwater Dependent Ecosystems**

No groundwater dependent ecosystems (GDEs) have been identified relevant to the CGO (including the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield).

Coffey (2018) conducted a review of the Bureau of Meteorology (BoM) *Groundwater Dependent Ecosystems Atlas* (2017). The BoM Atlas is based on the national and regional scale mapping and provides an indication of where groundwater and ecosystem interaction may occur. Coffey (2018) concluded the following:

- BoM identifies potential aquatic GDEs at Lake Cowal that would not be affected by the Modification, as seepage from Lake Cowal to the open pit during periods of inundation is negligible.
- BoM identifies potential terrestrial GDEs in the vicinity of the CGO (including the fringe of Lake Cowal) that are unlikely to be affected by the Modification, as they are more likely to be reliant on soil moisture and movement of water in the lake foreshore than the local or regional groundwater resources.

As these potential GDEs do not appear to be associated with the fractured rock groundwater system, they are not considered further.

### **Groundwater Quality**

#### *Mine Site*

Assessment of baseline groundwater salinity levels undertaken for the EIS by Coffey Partners International (1997) reported that:

- The alluvial groundwater system had very high salinity in the range of 19,000 to 72,000 microSiemens per centimetre ( $\mu\text{S}/\text{cm}$ ) within the open pit extent and 6,000 to 44,400  $\mu\text{S}/\text{cm}$  beneath the TSFs area.
- The fractured rock groundwater system also had very high salinity in the range of 50,900 to 63,700  $\mu\text{S}/\text{cm}$ .

Monitoring data indicates that, while open pit dewatering is causing a localised reduction in groundwater levels, groundwater pH and electrical conductivity (EC) appear to be unaffected by this drawdown (Appendix A).

Monitored groundwater pH levels and EC concentrations at the mine site are generally consistent with the background (i.e. pre-mining) monitored levels.

#### *Bland Creek Palaeochannel*

Groundwater quality records from monitoring bores in the Bland Creek Palaeochannel Borefield indicate decreasing salinity with depth (Appendix A). Salinity levels in the Cowra Formation are high in the Upper Cowra (i.e. up to approximately 30,000  $\mu\text{S}/\text{cm}$ ), lower in the Lower Cowra and approximately 2,000  $\mu\text{S}/\text{cm}$  in the Lachlan Formation (Appendix A).

EC records from groundwater monitoring bores in the Bland Creek Palaeochannel indicate salinity levels have remained reasonably constant within the three alluvial sequences since monitoring commenced in 2004. While fluctuations at BLPR2 have been recorded, salinity levels fell substantially in late 2013 before indicating an overall upward trend since late 2014 (Appendix A).

### **4.1.2 Potential Impacts**

In 2013, Coffey Geotechnics developed two numerical groundwater models to assess potential groundwater impacts associated with the CGO which were updated in 2016 as part of the Mine Life Modification (Coffey, 2016).

The mine site groundwater model was developed to predict the potential impacts associated with the CGO open pit, and was used to estimate groundwater inflow to the open pit and proportions from the alluvial and fractured rock groundwater systems consistent with the relevant Water Sharing Plans. The modelling considered both lake-fill and lake-dry scenarios.

The Bland Creek Palaeochannel groundwater model was used to assess potential impacts to regional aquifers associated with the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield.

The groundwater models were developed in consideration of available geological and hydrological data at the time, including the historic use of regional aquifers by other groundwater users.

Coffey Geotechnics (2013) also developed a solute transport model to predict potential impacts to water quality associated with seepage from the TSFs.

Kalf and Associates Pty Ltd (2013) peer reviewed the Hydrogeological Assessment for the Extension Modification (Coffey Geotechnics, 2013) and considered the modelling methodology, including model setup, structure and calibration, to be suitable.

The existing groundwater models have been updated for the Modification to consider additional groundwater data and incorporate the proposed changes to the approved CGO (i.e. a minor change to the mining schedule, changes to the TSF/IWL configuration and heights, continued open pit dewatering and use of the ML 1535 saline bores, and continued operation of the off-site Bland Creek Palaeochannel Borefield and Eastern Saline Borefield for water supply).

The updated models also incorporate changes to the CGO assessed in the *Hydrogeological Assessment for the Mine Life Modification* (Coffey, 2016).

#### **Potential Impacts to Lake Cowal**

Existing monitoring data indicates that groundwater inflow to the CGO open pit has not changed significantly during lake-fill conditions due to the hydraulic separation of the open pit and Lake Cowal (Section 4.1.1).

Coffey (2018) concludes the total impact to Lake Cowal associated with open pit dewatering at the CGO would be negligible (Appendix A). The incremental impact to Lake Cowal due to the Modification (i.e. in comparison to the approved CGO) would therefore also be negligible (Appendix A).

#### **Groundwater Inflows to the Open Pit**

##### *During Mining*

A minor increase in the maximum groundwater inflow is expected due to the Modification (Appendix A). Over the operational life of the Modification, total groundwater inflow to the open pit is predicted to comprise (Appendix A):

- a maximum of approximately 277 ML/annum from the fractured rock groundwater system; and
- a maximum of approximately 26 ML/annum from the alluvial groundwater system.

No significant difference between groundwater inflow for the lake-fill and lake-dry scenarios was predicted (Appendix A), indicating the continued hydraulic separation of the CGO open pit and Lake Cowal (Section 4.1.1).

##### *Post-Mining*

A minor increase in the maximum post-mining groundwater inflow is expected due to the Modification (Appendix A). Maximum post-mining groundwater inflow is expected to reduce to approximately 46.3 ML/annum.

#### **Predicted Drawdown due to Open Pit Dewatering**

The maximum predicted groundwater drawdown contours for the Modification in the alluvial and fractured rock groundwater systems are shown on Figure 4-3, along with drawdown contours for the existing/approved CGO.

As shown on Figure 4-3, the groundwater drawdown associated with the Modification would be generally limited to ML 1535 consistent with the approved mine predictions.

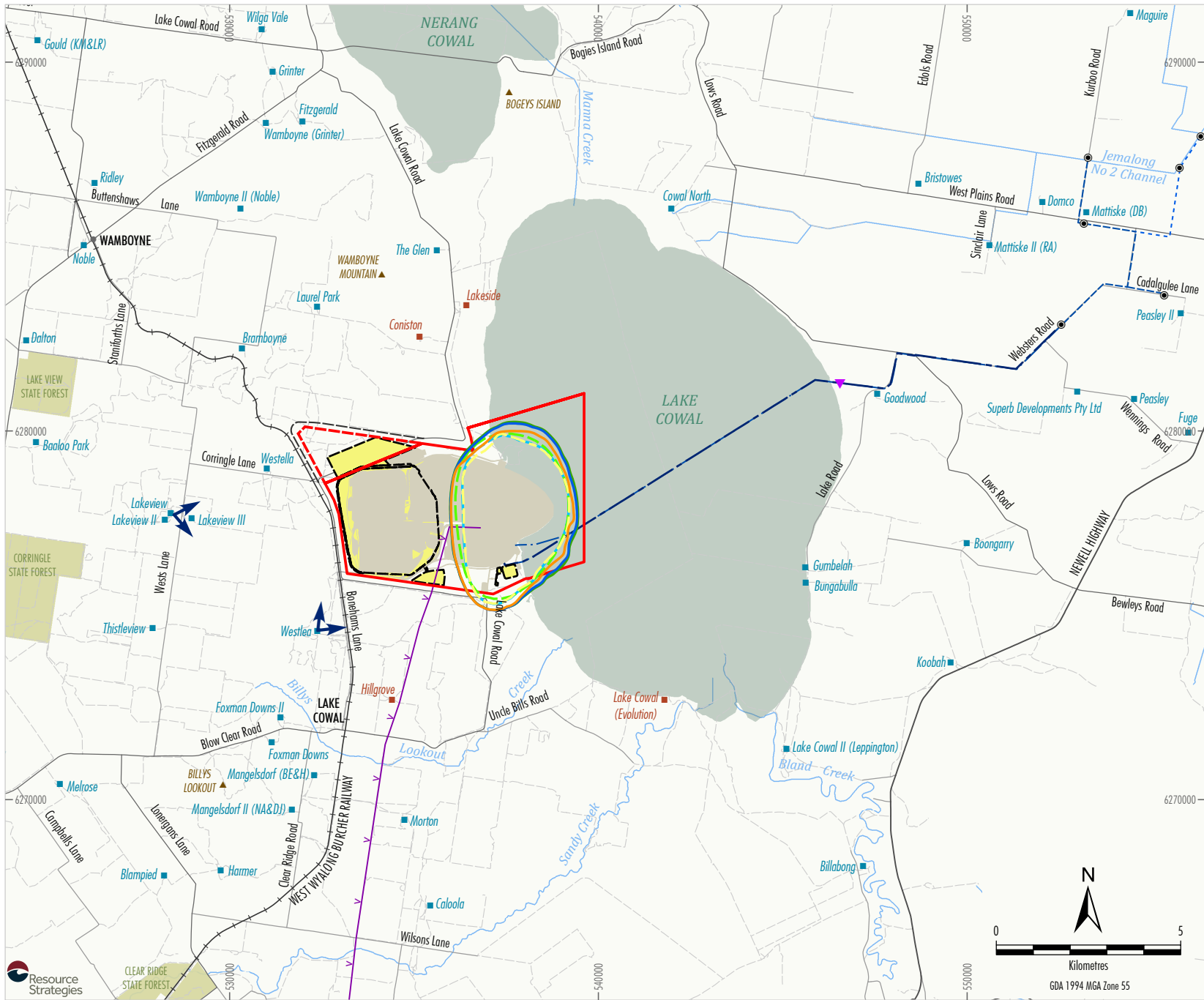
#### **Seepage from Tailings Storage Facilities and Integrated Waste Landform**

An assessment of potential impacts to groundwater quality due to seepage from the TSFs and IWL was undertaken using an analytical particle tracking approach (Appendix A).

Consistent with the findings of previous assessments for the approved CGO, seepage from the TSFs and IWL to the underlying aquifers was predicted to slowly migrate towards the open pit (Appendix A).

Therefore, solutes associated with potential seepage from the TSFs and IWL are expected to remain within groundwaters between the TSFs/IWL and the final void over the long term. The final void water level is expected to reach equilibrium well below spill level (Appendix B).

As no change to the geochemistry of tailings is expected, no change to the quality of seepage from the TSFs and IWL is expected due to the Modification. Therefore, no additional impacts to groundwater quality associated with seepage from the TSFs/IWL are expected due to the Modification (Appendix A).

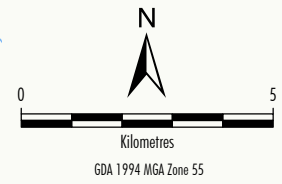


- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application (MLA 1)
  - Approximate Extent of Approved Surface Development
  - Approximate Extent of Additional Modification Surface Disturbance
  - Modification Component
  - Indicative Mine Water Supply Pipeline Duplication
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - State Forest
  - Railway
  - ▼ Electricity Transmission Line
  - Mine Water Supply Pipeline
  - Bland Creek Palaeochannel Borefield
  - Eastern Saline Borefield
  - ▼ Eastern Pump Station
  - ▼ Visual Assessment Location
  - Alluvial Groundwater**
  - Approved Predicted Maximum Drawdown (m)
  - Modification Predicted Maximum Drawdown (m)
  - Fractured Rock Groundwater**
  - Approved Predicted Maximum Drawdown (Saprolite Unit) (m)
  - Approved Predicted Maximum Drawdown (Saprock Unit) (m)
  - Modification Predicted Maximum Drawdown (Saprolite Unit) (m)
  - Modification Predicted Maximum Drawdown (Saprock Unit) (m)

Source: Evolution (2018); Coffey (2016; 2018); © NSW Department of Finance, Services & Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**Predicted Maximum Watertable Drawdown Contours at the End of Mine Life and Visual Assessment Locations**



**Figure 4-3**

**Seepage from Waste Rock Emplacements**

The existing northern and southern waste rock emplacements have been constructed with a low permeability layer such that any seepage from the waste rock emplacements is intercepted by this layer and preferentially flows towards the open pit (Section 2.6).

The low permeability basement layer constructed for the existing TSFs (e.g. targeted vertical permeability of no greater than  $1 \times 10^{-9}$  m/s) and other existing seepage control measures (Section 2.6) would be replicated for the IWL, and would continue to control seepage for the life of the Modification.

No additional impacts to groundwater quality associated with seepage from the waste rock emplacements are expected due to the Modification.

**Groundwater Levels around the Tailings Storage Facilities and Integrated Waste Landform**

Evolution would continue to monitor groundwater levels surrounding the IWL using existing active monitoring bores (located adjacent to the IWL footprint) and new monitoring bores proposed as part of the Modification (Section 4.1.3). If required, contingency measures to control groundwater levels would include (Appendix A):

- the installation of additional bores to pump groundwater back to the TSFs or IWL (i.e. pump back system); or
- the installation of trench drains and sumps to collect groundwater and control further rise in groundwater levels.

Following mine closure, the elevated groundwater levels surrounding the IWL are expected to dissipate over time as the head of water within the IWL and STSF gradually reduces (i.e. due to evaporation and groundwater movement towards the final void) (Appendix A).

**Continued Use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield**

The Modification would involve the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield in accordance with existing daily and annual extraction limits.

In addition, there would be no change to the existing Groundwater Contingency Strategy (i.e. trigger levels and contingency measures for the management of groundwater use in the Bland Creek Palaeochannel) (Section 4.1.1).

Coffey (2018) has considered potential cumulative drawdown effects associated with the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield for the Modification and the continued extraction of groundwater by other users (e.g. irrigators).

It is estimated that a yield of approximately 5.9 ML/day from the Bland Creek Palaeochannel (i.e. 4.4 ML/day from the Bland Creek Palaeochannel Borefield, and 1.5 ML/day from the Eastern Saline Borefield) could be sustained for the life of the Modification such that groundwater levels do not fall below relevant trigger levels at Bores GW036553, GW036597 and GW036611 (Appendix A).

The estimated extractions consider the continued extraction of groundwater by other users based on historic rates (Appendix A).

Historically, water supply operations have been undertaken in accordance with the Groundwater Contingency Strategy such that pumping from the Bland Creek Palaeochannel Borefield has ceased and alternative supply (e.g. Lachlan River surface water entitlements) has been used. Modelling in Appendix A shows that water levels have been maintained above the relevant contingency levels and that water levels can continue to be maintained for the remainder of the mine life.

**Groundwater Quality****Mine Site**

No additional impacts to groundwater quality in the aquifers surrounding the CGO are predicted due to groundwater inflow to the open pit or seepage from the TSFs or IWL for the Modification (Appendix A).

**Bland Creek Palaeochannel**

The continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield during the life of the Modification is not predicted to result in additional impacts to groundwater quality in the Bland Creek Palaeochannel (Appendix A).

## **Groundwater Users**

### *Mine Site*

There are no other known users of the saline aquifers surrounding ML 1535 and MLA 1 (i.e. other than Evolution). Given this, and that potential groundwater impacts are predicted to be generally contained within ML 1535, no impacts to other groundwater users are predicted.

### *Bland Creek Palaeochannel*

As described in Section 4.1.1, Evolution would continue to operate in accordance with the Groundwater Contingency Strategy and, therefore, no additional impacts to other groundwater users are predicted due to the continued use of the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield during the life of the Modification (Appendix A).

### **Baseflow Losses**

The existing surface water resources and their characteristics are described in Section 4.2.1.

No streams gaining baseflow from the surrounding groundwater system have been identified and therefore, no impacts associated with baseflow losses (i.e. stream leakage) are predicted due to the Modification.

### **Cumulative Impacts**

The predictive groundwater modelling considered relevant cumulative impacts associated with the extraction of groundwater by other users (e.g. for irrigation) (Appendix A).

Evolution would continue to operate the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield in accordance with the existing Groundwater Contingency Strategy to minimise impacts to other groundwater users.

Contours showing cumulative drawdown associated with the coincident extraction of water from the Lachlan Formation and Cowra Formation by Evolution and other groundwater users are provided in Appendix A.

### **Groundwater Dependent Ecosystems**

No GDEs relevant to the CGO (including the Bland Creek Palaeochannel Borefield and Eastern Saline Borefield) have been identified, and therefore, no impacts to GDEs are predicted due to the Modification (Appendix A).

## **4.1.3 Mitigation Measures, Management and Monitoring**

### **Groundwater Licensing**

A description of groundwater licensing requirements for the CGO and consideration of the requirements of the NSW Aquifer Interference Policy are provided in Attachment 4. A summary of water licensing requirements under the relevant Water Sharing Plans is provided in Table 4-1.

A comparison of Evolution's licence entitlements against predicted annual licensing requirements (Table 4-1) indicates adequate licences are available to account for the potential take of water associated with the Modification within the alluvial and fractured rock aquifers.

Post-closure annual licensing requirements for the Modification are predicted to be much less than the licensing requirements during operations (Appendix A), and as such, it is expected that Evolution would have adequate licences to account for the potential post-closure take of water from the alluvial and fractured rock aquifers.

### **Groundwater Monitoring and Management**

Existing groundwater monitoring and management measures, as detailed in the WMP, and the SWGMBMP would continue for the Modification.

Construction of the IWL would result in the decommissioning of several active groundwater bores that are currently used for groundwater level and quality monitoring in the vicinity of the existing TSFs. New monitoring bores to replace those destroyed by the IWL would be installed prior to construction of the IWL to allow for correlations between monitoring data for the destroyed and replacement bores. The indicative locations of the replacement monitoring bores are shown on Figure 4-1.

**Table 4-1  
Groundwater Licensing Requirement Summary**

Water Sharing Plan/Relevant Legislation	Management Zone/ Groundwater Source	Relevant Licence	Existing Licensed Volume <sup>1,2</sup> (ML/annum)	Predicted Maximum Annual Licensing Requirements <sup>1,3</sup> (ML/annum)
<i>Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012</i>	Upper Lachlan Alluvial Zone 7 Management Zone	Pit dewatering (including pit inflows) and saline bores in ML 1535 (WAL 36615)	366	282
		Bland Creek Palaeochannel Borefield (WAL 31864)	3,650	3,650
		Eastern Saline Borefield (WAL 36569)	750 <sup>4</sup> (per bore)	548
<i>Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011</i>	Lachlan Fold Belt Murray Darling Basin Groundwater Source	Pit dewatering (WAL 36617)	3,294	277

<sup>1</sup> Assuming 1 ML per unit share.

<sup>2</sup> Source: CGO WMP.

<sup>3</sup> Source: Appendix A.

<sup>4</sup> Eastern Saline Borefield licences have zero ML licence allocation with an allowable temporary transfer of up to 750 ML/annum per bore.

The WMP and SWGMBMP would be updated, as required, to incorporate the Modification and the recommendations made by Coffey (2018), including:

- Continued groundwater monitoring to validate the predictive modelling, particularly in the vicinity of the open pit, TSF and ML 1535 saline groundwater supply borefield (when in use).
- Continued monitoring of groundwater salinity in the Bland Creek Palaeochannel Borefield to assess potential saline migration.
- A final pit void water balance post-mine closure would be conducted prior to the end of mine life to assess long-term water levels in the pit void and the potential impact on groundwater quality in the immediate vicinity of the pit void.
- Establishment of new monitoring bores to replace those that would be displaced by the IWL.

#### **Groundwater Users**

The existing Groundwater Contingency Strategy (Section 4.1.1), as described in the WMP, would continue to be implemented to manage groundwater levels within the Bland Creek Palaeochannel.

## **4.2 SURFACE WATER**

A Hydrological Assessment for the Modification was conducted by HEC (2018) and is presented in Appendix B.

The existing CGO site water management infrastructure and proposed changes for the Modification are described in Sections 2.7 and 3.7, respectively.

A description of the existing surface water environment relevant to the CGO is provided in Section 4.2.1. Section 4.2.2 describes the potential impacts of the Modification. Section 4.2.3 outlines the mitigation, management measures and monitoring relevant to surface water proposed for the Modification.

### **4.2.1 Existing Environment**

#### **Baseline Surface Water Data**

HEC (2018) considered the following data for the Hydrological Assessment prepared for the Modification:

- long-term regional rainfall and evaporation records from the BoM weather stations;
- rainfall and evaporation records since 2002 from the CGO meteorological station (Figure 2-3);

- gauging station flow data on the Lachlan River and Bland Creek;
- data collected by Evolution from surface water quality monitoring sites within ML 1535 (including the UCDS, contained water storages and open pit) and Lake Cowal and surrounds (Figures 2-3 and 4-1);
- water usage and water quality data from the existing CGO water management system;
- waste rock emplacement rehabilitation monitoring programmes; and
- other regional topographic mapping data.

The Hydrological Assessment has also considered the requirements of the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012* (which applies to all unregulated water sources in the Lachlan catchment) and the *Water Sharing Plan for the Lachlan Regulated River Water Source 2016*.

### **Hydrological Setting**

The CGO is located on the western side of Lake Cowal, an ephemeral freshwater lake predominantly filled by runoff from Bland Creek to the south, and flood breakout from the Lachlan River to the north (Figure 1-2).

The Lachlan River is the major regional surface water system, forming part of the Murray Darling Basin. Flows in the Lachlan River are regulated by releases from Wyangala Dam (Appendix B).

Breakout from the Lachlan River to Lake Cowal occurred in late 2010, in the first half of 2012 and again in 2016. No breakouts occurred between the period 1998 and 2010 (Appendix B).

Lake Cowal occupies an area of 105 square kilometres (km<sup>2</sup>), holds approximately 150 gigalitres of water (Appendix B) and has a maximum depth of approximately 4 m when full. When flows are sufficient, Lake Cowal overflows into Nerang Cowal to the northwest, and ultimately drains to the Lachlan River via Bogandillon Creek (Appendix B).

Bland Creek drains a catchment of approximately 9,500 km<sup>2</sup> which ultimately reports to Lake Cowal at its southern end (Appendix B).

Bland Creek and all other tributaries of Lake Cowal (including the drainage lines surrounding the CGO) are ephemeral. Flow records for Bland Creek indicate that runoff in the Bland Creek catchment is low, averaging approximately 5% of rainfall (Appendix B).

### **Site Water Management**

The existing CGO water management infrastructure is designed to separate Lake Cowal from the CGO, contain potentially contaminated water (contained water) generated within the mining area, and to divert all other water around the perimeter of the site (Section 2.7).

The major components of CGO water management infrastructure are (Section 2.7):

- lake isolation system (comprising the perimeter waste rock emplacement, permanent lake protection bund and temporary isolation bund);
- UCDS;
- ICDS;
- integrated erosion, sediment and salinity control system; and
- open pit sump.

The effectiveness of the lake isolation system was demonstrated under peak water levels in Lake Cowal during the lake-fill events in recent years. During the lake-fill periods, no material increase in groundwater inflow to the open pit occurred, based on pit dewatering monitoring data. This indicates that the lake protection bund and lacustrine clay on the lake's bed are preventing significant loss of water from the lake to the open pit (Section 4.1.2 and Appendix A).

### **Lake Cowal Surface Water Quality**

Baseline water quality in Lake Cowal was typically slightly to moderately alkaline (pH 8.27 to 8.67) with low to moderate suspended solids concentrations (total suspended solids concentrations of 24 mg/L to 222 mg/L) (North Limited, 1998).

EC was also low, varying between 222  $\mu$ S/cm and 1,557  $\mu$ S/cm (North Limited, 1998) and appeared to be inversely related to lake volume (i.e. solute concentrations increased as lake volumes decreased).

Baseline cadmium, arsenic, lead, mercury and zinc levels were low, and mostly below relevant detection limits, however, copper concentrations were found to be higher than the Australian and New Zealand Environment and Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) (2000) limit for the protection of aquatic ecosystems (Appendix B).



Lake Cowal water quality monitoring and analysis is undertaken at the CGO in accordance with the requirements of Development Consent (DA 14/98), EPL 11912, the WMP and SWGMBMP.

Review of water quality monitoring results to date indicates the following:

- the range of pH was high relative to ANZECC/ARMCANZ (2000) default triggers and baseline ranges, however has been similarly elevated at sites near and distant to the CGO;
- average copper, lead and zinc concentrations were high relative to both ANZECC/ARMCANZ (2000) default triggers and baseline ranges, however has been similarly elevated at sites on the opposite (eastern) side of Lake Cowal;
- average turbidity was significantly higher than the ANZECC/ARMCANZ (2000) default trigger value and higher than baseline levels, however turbidity levels have occurred uniformly at sites close to and distant from the CGO; and
- total phosphorous concentrations were significantly higher than the ANZECC/ARMCANZ (2000) default trigger value for fresh water lakes however concentrations have been similar at sites both close to the CGO and on the other side of Lake Cowal (it is also noted, measured total phosphorus is less than the baseline average).

CGO water management infrastructure fully contains surface water runoff from the CGO due to design storage capacity.

The monitoring data supports that there is no evidence that the existing CGO has resulted in changes to water quality in Lake Cowal (Appendix B).

#### **Licensed Surface Water Extraction from the Lachlan River**

Water from the Lachlan River is used, when required, to meet external water demands for the CGO in accordance with High Security (WAL 14981 and WAL 13749) and General Security (WAL 13748) WALs held by Evolution (Section 2.8.4).

Throughout the operating history of the CGO, the Lachlan River regulated source has proven to be a reliable supply of temporary water (Appendix B) (refer to Section 4.2.2).

#### **Post-closure Water Management**

A description of the post-closure water management strategy for the approved CGO is provided in Appendix B. Key aspects of the post-closure water management strategy for the approved CGO include:

- the lake isolation system and UCDS would be maintained post-closure;
- the open pit would be left as a final void; and
- runoff from rehabilitated mining landforms would be directed to the final void via a network of low energy drainage swales.

As the final void for the approved CGO was predicted to act as a permanent groundwater sink, and would have no outflow apart from evaporation (i.e. would not spill under any climatic scenario), water quality in the final void was predicted to trend to hyper-salinity (Appendix B). The post-closure water management strategy would remain unchanged for the Modification.

#### **4.2.2 Potential Impacts**

##### **Revised Site Water Balance**

A revised site water balance for the Modification has been prepared by HEC (2018) (Appendix B).

No spills from contained water storages were predicted for the Modification (Appendix B), including for contained water storages D1 and D4 (Figure 3-1), which would continue to be managed via pumping as required (Appendix B).

##### **Surface Water Quality**

Overall there has been no apparent causal link between the existing operations at the CGO and water quality changes in Lake Cowal (Appendix B).

The Modification would not change the existing lake isolation system, or design objectives of the ICDS and UCDS.

Given the above, HEC (2018) concludes there would be a low risk of more than a negligible hydrological impact on Lake Cowal due to the Modification (Appendix B).

### **Catchment and Hydrology**

Changes to the UCDS and ICDS are proposed as part of the Modification to accommodate the IWL. The objective of the reconstructed UCDS would be to mimic the existing UCDS dimensions and profiles. As the change in catchment excised by the Modification that would otherwise report to Lake Cowal is limited to 0.64 km<sup>2</sup> changes in hydrology in Lake Cowal would be negligible (Appendix B).

The pipeline duplication would include the implementation of control measures outlined in the WMP, including the installation of sediment control measures during construction. With the implementation of these measures, potential impacts on surface water resources are expected to be negligible (Appendix B). Should Lake Cowal contain water at the time of construction, the pipeline may be laid onto the lake bed via boat or floating pontoon for later burial.

Runoff from the soil stockpile to be located within MLA 1 would be directed to a currently approved sediment basin to be constructed at the eastern boundary of the stockpile area (Appendix B). The upslope stockpile diversions and the sediment basin would be constructed and maintained in accordance with the guidelines in Landcom (2004) and NSW Department of Environment, Climate Change and Water (DECCW) (2008).

In addition, the explosives compound and magazine would be located outside of the UCDS. Water management at this infrastructure would be consistent with the principles in the WMP, including:

1. Minimising Disturbance Areas.
2. Containment of Potentially Contaminated Water.
3. Recycling of Contained Water.

Accordingly, water management of this infrastructure would involve a contained catchment, with captured water stored and pumped back to the CGO water management system (Appendix B).

### **Geochemical Considerations**

The Modification would not result in changes to the ore or waste rock mined; therefore, no changes in geochemistry are anticipated.

### **Licensed Surface Water Extraction from the Lachlan River**

Water from the Lachlan River would continue to be accessed at the CGO for the Modification by purchasing temporary water available from the regulated Lachlan River trading market in accordance with High Security (WAL 14981 and WAL 13749) and General Security (WAL 13748) WALs held by Evolution (Section 2.8.4).

Site water supply would continue to be preferentially supplied from internal water sources followed by external groundwater sources, including the Lachlan River (Section 3.8.5). Notwithstanding, since the commencement of operations at the CGO there has been a reliable supply of temporary water available from the Lachlan River trading market, including during periods of drought. DI-Water trading records show that between approximately 4,000 ML and 274,000 ML of temporary water has been traded annually since records began in the 2004 to 2005 season (Appendix B).

By comparison, the predicted average water requirement from the Lachlan River under a 10<sup>th</sup> percentile (dry) rainfall sequence is 1,892 ML over the life of the Modification (Table 3-2) (Appendix B).

Modelling indicates that reliance on external sources is likely to slightly increase as a result of the Modification (Appendix B).

### **Other Surface Water Users**

As described above, no additional impacts to the water quality or hydrology of Lake Cowal are predicted due to the Modification, and surface water extraction from the Lachlan River would continue to be undertaken in accordance with the conditions of WALs.

On this basis, no additional impacts to other surface water users are predicted due to the Modification.

### **Post-closure Water Management**

The Modification would not change the objectives of the existing post-closure water management strategy (Appendix B). The conceptual post-closure water management system is shown on Figure 3-4.

No changes to the final void water balance would occur for the Modification, as no changes to the open pit are proposed (Appendix B).

Further description regarding post-closure landform concepts is discussed in Section 5.

#### 4.2.3 Mitigation Measures, Management and Monitoring

##### **Relevant Management and Monitoring Plans**

The WMP, SWGMBMP and ESCMP would be reviewed, and revised as necessary, to reflect the Modification.

Runoff from the soil stockpile area in MLA 1 would be directed to a currently approved sediment basin to be constructed at the eastern boundary of the stockpile area (Appendix B). The upslope stockpile diversions and the sediment basin would be constructed and maintained in accordance with the WMP.

##### **Surface Water Licensing**

Within the *Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012*, the CGO is located within the Western Bland Creek Water Source.

The *Water Sharing Plan for the Lachlan Regulated River Water Source 2016* covers licensed surface water accessed for the CGO from the Lachlan River. No additional surface water access licences beyond those already held by Evolution (i.e. WAL 14981, WAL 13749 and WAL 13748) from the Lachlan River would be required for the Modification. However, Evolution would continue to investigate the availability/use of additional licence allocations for purchase and use for the CGO.

Further detail regarding surface water access licenses held by Evolution is provided in Attachment 4.

##### **Harvestable Right**

None of the storages on-site are used to harvest runoff from land and all storages are used to contain runoff, mine water or effluent, or are used to control soil erosion (Appendix B). It is concluded, that these storages are not relevant to any harvestable rights calculation.

#### 4.3 FLORA AND FAUNA

A terrestrial ecology assessment (i.e. the Biodiversity Assessment Report and Biodiversity Offset Strategy) was undertaken by Resource Strategies (2018) and is presented as Appendix C. The assessment has been Peer Reviewed by Dr Colin Driscoll. Supporting flora and fauna studies were undertaken by AMBS Ecology & Heritage (AMBS) (2018a, 2018b).

The biodiversity assessments were prepared in accordance with the SEARs for the Modification and relevant State and Commonwealth requirements. The NSW *Biodiversity Offset Policy for Major Projects* (the NSW Offset Policy) (OEH, 2014a) (and supporting NSW *Framework for Biodiversity Assessment* [FBA] [OEH, 2014b]) was applied.

For the purpose of the Biodiversity Assessment Report and Biodiversity Offset Strategy, the modified approximate extent of surface development is represented by two Biodiversity Assessment Report Footprints (BAR Footprints) shown on Figures 4-4a and 4-4b. The BAR Footprints show the additional surface disturbance area outside of the CGO under Development Consent (DA 14/98).

A description of the existing environment relating to the biodiversity values of the BAR Footprints is provided in Section 4.3.1. Section 4.3.2 describes the potential impacts of the Modification. Section 4.3.3 outlines mitigation measures, management and monitoring and Section 4.3.4 describes the Biodiversity Offset Strategy.

#### 4.3.1 Existing Environment

##### **Regional Setting**

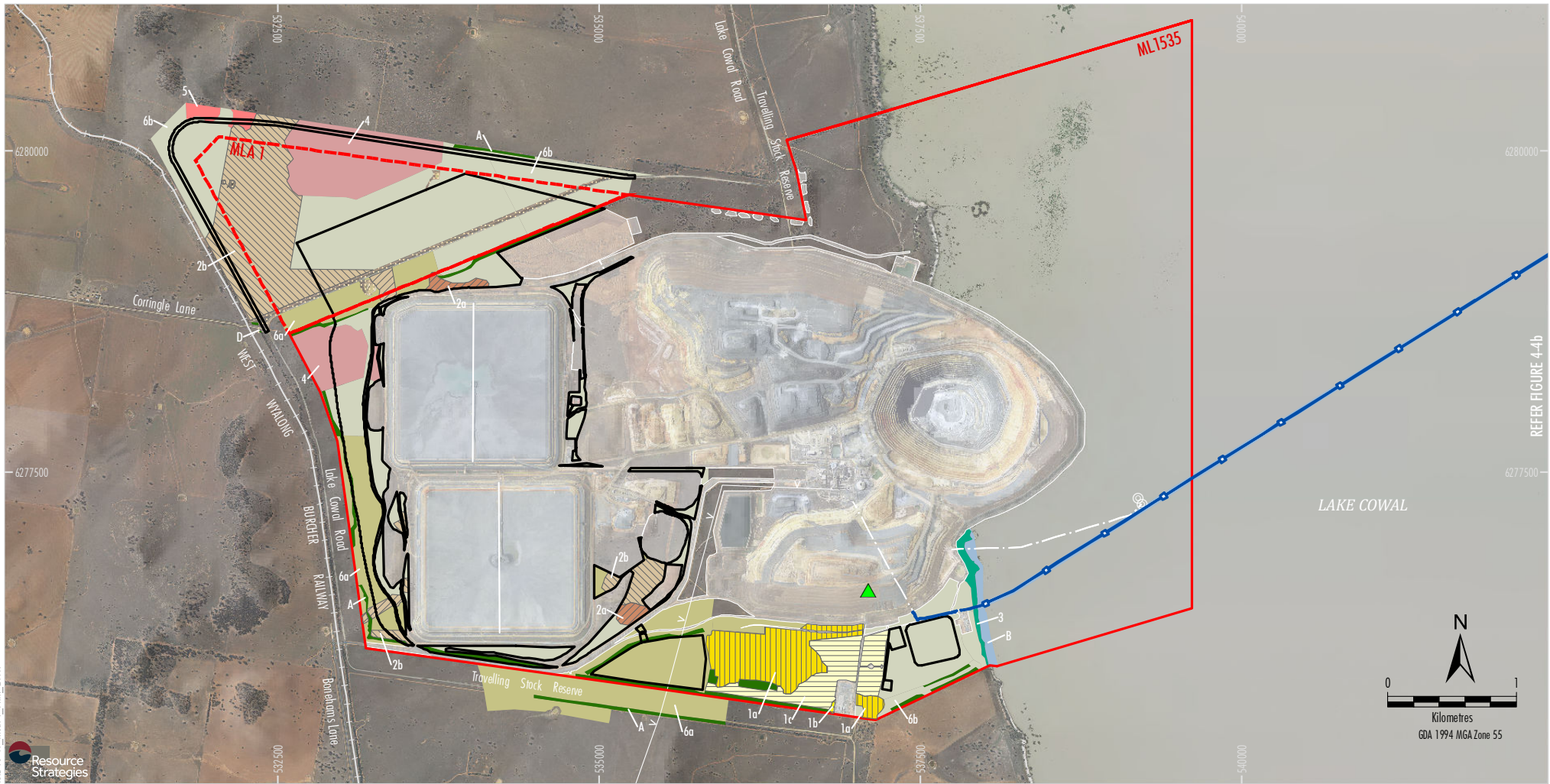
The CGO is located in the central north-west of the NSW South Western Slopes *Interim Biogeographic Regionalisation for Australia Bioregion* (Department of the Environment, 2012). The CGO is also located in the Central West Local Land Services region.

##### **Local Setting**

The existing CGO is located on the western shoreline of Lake Cowal, an ephemeral lake which experiences periods of drying and filling (Figure 4-4a). The additional disturbance area within ML 1535 associated with the Modification is located adjacent to existing mine infrastructure and TSFs in former farmland that has been semi-cleared and used for grazing of livestock. The pipeline duplication runs parallel to the existing pipeline from the Mine Site to the eastern side of Lake Cowal (Figure 1-2).

Areas with native vegetation have been set aside for biodiversity conservation by Evolution as part of the existing CGO (i.e. the Northern Offset Area and Southern Offset Area [Figure 4-5]) (Barrick [Cowal] Limited [Barrick]).

HAL-16-41\_Mod4\_PRRM\_219A



REFER FIGURE 4-4b

- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application Boundary (MLA 1)
  - Approximate Extent of Approved
  - Surface Development
  - BAR Footprint - Mine Site
  - BAR Footprint - Pipeline
  - Threatened Ecological Communities
  - Grey Box Woodland EEC (BC Act and EPBC Act)
  - Grey Box Woodland EEC (BC Act)
  - Weeping Myall Woodland EEC (BC Act and EPBC Act)
  - Weeping Myall Woodland EEC (BC Act)

- VEGETATION MAPPING**
- 1a Weeping Myall Open Woodland (Semi Cleared in Moderate Condition) (LA212)
  - 1b Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212)
  - 1c Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212)
  - Grassy Woodlands - Floodplain Transition Woodlands
  - 2a Inland Grey Box - White Cypress Pine Woodland (Semi Cleared in Moderate Condition) (LA152)
  - 2b Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)
  - 3 Forested Wetlands - Inland Riverine Forests
  - River Red Gum Forest (Moderate Condition) (LA191)
  - Semi-arid Woodlands (Grassy sub-formation) - Northwest Floodplain Woodlands
  - 4 Belah Woodland (Low Condition) (LA105)
  - Semi Arid Woodland (Shrubby sub-formation) - Inland Rocky Hill Woodlands
  - 5 Dwyer's Red Gum - White Cypress Pine - Currawang Woodland (Moderate Condition) (LA144)

- 6a Grasslands - Western Slopes Grasslands
- 6b Highly Modified Derived Grasslands (Moderate Condition) (LA138)
- Highly Modified Derived Grasslands (Low Condition) (LA138)
- Other Map Units
- A Plantings
- B Lake Bed
- D Cleared
- Threatened Flora Species
- ▲ Austral Pillwort

Source: AMBS (2018); OEH (2017); © NSW Department of Finance, Services & Innovation (2017)  
 Orthophoto: Evolution (Oct 2017)



**CGO PROCESSING RATE MODIFICATION**  
**Vegetation Communities and Threatened Flora Species - Mine Site**

**Figure 4-4a**



HAL-16-41\_Mod4\_PRM\_220A



- LEGEND**
- Approximate Extent of Approved Surface Development
  - BAR Footprint - Pipeline
  - Threatened Ecological Communities
  - Weeping Myall Woodland EEC (BC Act and EPBC Act)
  - Weeping Myall Woodland EEC (BC Act)

- VEGETATION MAPPING**
- Semi-arid Woodlands (Grassy sub-formation) - Riverine Plain Woodlands
- 1a Weeping Myall Open Woodland (Semi Cleared in Moderate Condition) (LA212)
  - 1b Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212)
  - 1c Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212)
- Forested Wetlands - Inland Riverine Forests
- 3 River Red Gum Forest (Moderate Condition) (LA191)
- Other Map Units
- B Lake Bed
  - C Cropping
- Threatened Flora Species
- Austrostipa wakaolica*

Source: AMBS (2018); OEH (2017); © NSW Department of Finance, Services & Innovation (2017)  
 Orthophoto: Evolution (Oct 2017)



CGO PROCESSING RATE MODIFICATION  
 Vegetation Communities and  
 Threatened Flora Species  
 - Pipeline

Figure 4-4b



ML1535-41\_Mod14\_PRM\_221A

- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application Boundary (MLA 1)
  - Approximate Extent of Approved Surface Development
  - Existing Offset Area
  - Proposed Offset Area
  - BAR Footprint - Mine Site
  - BAR Footprint - Pipeline
  - Local Management Initiatives
  - Remnant Vegetation Enhancement Program Area
  - Compensatory Wetland

Source: Evolution (2018); © NSW Department of Planning and Environment (2017); Department of Finance, Services & Innovation (2017)  
 Orthophoto: Evolution (Oct 2017)



**CGO PROCESSING RATE MODIFICATION**  
**Existing Approved and Proposed Biodiversity Offset Areas**

**Figure 4-5**

### **Native Vegetation and Threatened Ecological Communities**

Flora surveys of the BAR Footprints and surrounds were conducted by AMBS (2018a) (Attachment A of Appendix C).

The vegetation surveys included sampling of floristic plots, collection of site condition data (OEH, 2014b) and targeted searches for threatened ecological communities listed under the NSW *Biodiversity Conservation Act, 2016* (BC Act) and the EPBC Act that could potentially occur.

The total BAR Footprint is 315.2 ha in size with 286.7 ha comprising native vegetation, the remaining 28.5 ha consists of previously cleared land (non-native), plantings and lake bed. The 286.7 ha of native vegetation in the BAR Footprint contains 17.9 ha of woodland (6.2%), 8 ha of semi-cleared woodland (2.8%) and 260.8 ha of derived grassland (91%) (Table 4-2; Figures 4-4a and 4-4b).

The derived grasslands in the Modification locality occur as a result of native grassland species that have recolonised land which has been previously cultivated (e.g. via windblown or animal carried seed) or are native grasslands that remain after removal of the woody canopy vegetation (shrubs and trees).

Six native vegetation communities were identified within the BAR Footprints (Table 4-2; Figures 4-4a and 4-4b).

*Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions* Endangered Ecological Community (EEC) listed under the BC Act (Grey Box EEC) occurs in the BAR Footprint associated with the mine site (Vegetation Community 2a and 2b – approximately 30 ha). Approximately 11.5 ha of this community represents the *Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* EEC listed under the EPBC Act (Grey Box EEC).

*Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* EEC listed under the BC Act (Weeping Myall Woodlands EEC) occurs within the BAR Footprint for the pipeline duplication (Vegetation Community 1a, 1b and 1c – approximately 4.5 ha). Approximately 1.5 ha of this community represents the Weeping Myall Woodlands EEC listed under the EPBC Act.

**Table 4-2  
Vegetation Clearance in the BAR Footprint**

Vegetation Community (BVT)		Area (ha)	Credit Requirement
1a	Weeping Myall Open Woodland (Semi Cleared in Moderate Condition) (LA212)	1.3 <sup>A, B</sup>	51
1b	Weeping Myall Open Woodland (Semi Cleared in Low Condition) (LA212)	0.2 <sup>A, B</sup>	58
1c	Weeping Myall Open Woodland (Derived Grassland in Low Condition) (LA212)	3.0 <sup>A</sup>	
2a	Inland Grey Box - White Cypress Pine Woodland (Semi Cleared in Moderate Condition) (LA152)	6.5 <sup>C</sup>	816
2b	Inland Grey Box - White Cypress Pine Woodland (Derived Grassland in Low Condition) (LA152)	23.5 <sup>D</sup>	
3	River Red Gum Forest (Moderate Condition) (LA191)	0.4	19
4	Belah Woodland (Low Condition) (LA105)	16.5	193
5	Dwyer's Red Gum - White Cypress Pine - Currawang Woodland (Moderate Condition) (LA144)	1.0	18
6a	Highly Modified Derived Grasslands (Moderate Condition) (LA138)	63.5	679
6b	Highly Modified Derived Grasslands (Low Condition) (LA138)	170.8	1,853
<b>Total</b>		<b>286.7</b>	<b>3,687</b>

<sup>A</sup> Equivalent to the Myall Woodland EEC listed under the BC Act.

<sup>B</sup> Equivalent to the Myall Woodland EEC listed under the EPBC Act.

<sup>C</sup> Equivalent to the Grey Box EEC listed under the EPBC Act and BC Act.

<sup>D</sup> 23.5 ha equivalent to the Grey Box EEC listed under the BC Act, and approximately 5 ha equivalent to the Grey Box EEC listed under the EPBC Act.

BVT = Biometric Vegetation Type.

### Threatened Flora Species

Many flora surveys and monitoring programmes have been conducted in ML 1535 and the broader Lake Cowal catchment as detailed in Appendix C. Past flora studies considered in Appendix C include:

- regional studies between 1987 and 2008;
- flora species recorded within ML 1535 and surrounds before operations (between 1969 and 2003);
- flora surveys for the *Cowel Gold Mine E42 Modified Request Modification Environmental Assessment* (Barrick, 2008);
- Australian Museum Business Services (2012) targeted surveys within ML 1535 and surrounds; and
- flora species recorded during monitoring at the CGO (2008 – present).

The *Cowel Gold Operations Processing Rate Modification Flora and Fauna Survey Report* (AMBS, 2018a) is provided in Attachment A of Appendix C.

AMBS (2018a) characterised the flora using standard techniques (quadrats, rapid data points, vegetation mapping, condition assessment and threatened species searches) in accordance with relevant guidelines (NSW Department of Environment and Conservation [DEC], 2004). Targeted searches for potentially occurring threatened flora species listed under the BC Act and EPBC Act were conducted for the Modification.

A description of the methodology employed during each of these surveys is provided in Appendix C.

No threatened flora species have been recorded within the BAR Footprint.

### Threatened Fauna Species

Fauna in ML 1535 and the broader Lake Cowal catchment has also been well documented as described in Appendix C. Thirteen fauna surveys undertaken in ML 1535 and the broader Lake Cowal catchment prior to commencement of the CGO (i.e. between 1969 and 2004) were considered in Appendix C. During the operation of the CGO, fauna species have been recorded during the following activities (Appendix C):

- waterbird monitoring (1989 – present);
- fauna species recorded within ML 1535 during operations (2005 – present);

- pre-clearance fauna surveys within ML 1535 (between 2005 and 2017); and
- monitoring of daily and seasonal fauna usage of the TSFs within ML 1535 (2006 and 2017).

Fauna monitoring has been undertaken at Lake Cowal for CGO. Waterbird monitoring has been undertaken at Lake Cowal three times a year since 1989. This monitoring is undertaken by Professor Peter Gell (Federation University) and the substantial dataset has been consolidated by the Australian Museum Business Services (2013). Fish and aquatic habitat surveys have been undertaken in Lake Cowal by frc Environmental (2011, 2012, 2016 and 2017).

The Modification area was surveyed in 2017 by AMBS (AMBS, 2018a). During this survey, threatened species were targeted and a habitat assessment was undertaken (AMBS, 2018a). This survey included fauna habitat within ML 1535, surrounding Evolution-owned land and water supply pipeline corridor (AMBS, 2018a).

The fauna survey effort in ML 1535 has exceeded the minimum requirements in the NSW survey guidelines for threatened species (DEC, 2004; DECCW, 2009). Targeted searches for potentially occurring threatened fauna species listed under the BC Act and EPBC Act have been conducted on numerous occasions, over multiple seasons and years.

An inspection of the fauna habitat at the pipeline duplication corridor (AMBS, 2018a) is documented in Appendix C.

Five threatened fauna species have been recorded within the BAR Footprint, namely:

- Black Falcon (*Falco subniger*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis subsp. temporalis*);
- Little Eagle (*Hieraaetus morphnoides*);
- Superb Parrot (*Polytelis swainsonii*); and
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*).

All of the above threatened fauna species are ecosystem credit species (i.e. species that can be predicted to be present based on a habitat assessment). The Superb Parrot is a dual ecosystem/species credit species.



### **Threatened Species - Species Credit Species under the NSW Offset Policy**

The Superb Parrot is a species credit species for breeding habitat (not foraging habitat). Potential breeding habitat for the species occurs in the River Red Gum Forest (LA191) along the edge of Lake Cowal and approximately 0.4 ha occurs in the BAR Footprint associated with the pipeline duplication.

The Superb Parrot has previously been recorded within the BAR Footprint. There is no evidence of Superb Parrot nesting in the BAR Footprints or in the surrounds from the extensive field surveys which have been undertaken at the CGO (AMBS, 2018a) (Appendix C). However, potential breeding habitat for the Superb Parrot does occur in the BAR Footprint associated with the pipeline duplication.

### **Landscape Features that Require Further Consideration under the NSW Offset Policy**

The pipeline duplication would disturb the lake bed of the Lake Cowal/Wilbertroy Wetlands (NSW040) which is listed on the *Directory of Important Wetlands* (DEE, 2018a). In accordance with the FBA, this disturbance requires further consideration.

The potential impacts from the Modification on these wetlands are considered further in Appendix C and Section 4.3.2.

### **Introduced Flora and Noxious Weeds**

The occurrence of weeds within the BAR Footprint and surrounds is generally high, with a total of 63 introduced species identified during surveys (Attachment B of Appendix C).

### **Introduced Fauna**

Of the 128 fauna species recorded during surveys, seven species were introduced (Attachment B of Appendix C);

- Red Fox (*Vulpes vulpes*);
- Feral Cat (*Felis catus*);
- Dog (*Canis lupus familiaris*);
- European Brown Hare (*Lepus europaeus*);
- Cattle (*Bos taurus*);
- House Mouse (*Mus musculus*); and
- Common Starling (*Sturnus vulgaris*).

### **Matters of National Environmental Significance**

In 2001, the CGO was referred under the EPBC Act and determined 'not a controlled action' (EPBC 2001/421).

No flora species threatened under the EPBC Act have been recorded within the BAR Footprint for the Modification.

AMBS undertook targeted surveys for potentially occurring threatened ecological communities listed under the EPBC Act in accordance with relevant listing advice (Appendix C).

Grey Box EEC listed under the EPBC Act is present in the BAR Footprint associated with the mine site. Approximately 11.5 ha of Grey Box EEC would be cleared for the Modification (Figures 4-4a and 4-4b).

Weeping Myall Woodlands EEC listed under the EPBC Act is present in the BAR Footprint associated with the pipeline duplication. Approximately 1.5 ha of Weeping Myall Woodlands EEC be cleared for the Modification (Figures 4-4a and 4-4b).

AMBS undertook targeted surveys for the Superb Parrot listed under the EPBC Act. Details of the scope, timing and methodology for the surveys, and consistency with published Australian Government guidelines and policy statements, are provided in Attachment A of Appendix C.

There is no evidence of Superb Parrot nesting in the BAR Footprint or in the surrounds from the extensive monitoring and field surveys which have been undertaken at the CGO (Section 4.3.1). However, potential breeding habitat for the Superb Parrot does occur in the BAR Footprint associated with the pipeline duplication.

### **NSW Fisheries Management Act, 1994 Threatened Species and Communities**

The Macquarie Perch (*Macquaria australasica*) (Endangered) and Silver Perch (*Bidyanus bidyanus*) (Vulnerable), listed under the *NSW Fisheries Management Act 1994* (FM Act) were recorded within the Lachlan River Catchment area between 1947 and 1992. No threatened fish species were recorded within Lake Cowal during targeted surveys in 2011, 2012, 2016 or 2017 (undertaken in conditions when Lake Cowal was nearly full) (Appendix C).

The *Freshwater Threatened Species Distribution Maps* (Department of Primary Industries [DPI], 2018) indicate that three species listed under the FM Act have a distribution that includes the locality of Lake Cowal. This is discussed further in Appendix C.

The *Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Lachlan River Endangered Ecological Community* (Lachlan River Catchment EEC) is listed under the FM Act and includes Lake Cowal in the listing (DPI Threatened Species Unit, 2006).

#### 4.3.2 Potential Impacts

This section describes the potential impacts associated with the Modification. A description of the potential impacts associated with the BAR Footprint is provided directly below.

##### **Native Vegetation and Threatened Ecological Communities**

The Modification would result in the removal of 286.7 ha of native vegetation, of which most (91%) is derived grassland in low/moderate condition (260.8 ha). (Table 4-2; Figures 4-4a and 4-4b).

A number of measures to avoid and minimise impacts on biodiversity have been developed for the approved CGO (that are also relevant to the Modification) (Section 4.3.3). These would be continued for the Modification (e.g. vegetation clearance protocols and weed management).

Potential indirect impacts from the Modification on vegetation (and other terrestrial biodiversity) have been assessed in Appendix C.

The FBA (OEH, 2014b) requires the use of an online programme (the *Credit Calculator for Major Projects and BioBanking* [the Credit Calculator] [OEH, 2016]) to assess biodiversity impacts and determine the biodiversity offset requirements for those impacts.

The result of running the Credit Calculator is that the Modification requires a Biodiversity Offset Strategy which accounts for a total of 3,687 ecosystem credits (Table 4-2).

##### **Threatened Species - Species Credit Species under the NSW Offset Policy**

The Modification requires a Biodiversity Offset Strategy which accounts for species credits for the Superb Parrot due to the removal of 0.4 ha of vegetation (River Red Gum Forest) which is considered breeding habitat under the NSW Offset Policy, requiring 19 species credits to be offset. (Appendix C).

##### **Landscape Features that Require Further Consideration under the NSW Offset Policy**

Further consideration is given to the impacts on Lake Cowal/Wilbertray Wetlands associated with the Modification in Appendix C.

As part of the Modification, the water supply pipeline which already exists across Lake Cowal would be duplicated along its length, up to Bore 4 of the Bland Creek Palaeochannel Borefield.

Excavation within the pipeline corridor would be up to approximately 6 m wide and approximately 1 m deep. Soil would then be backfilled to ground level, and any excess soil would be spread over the pipeline disturbance area.

Should Lake Cowal contain water at the time of construction, the pipeline may be laid onto the lake bed via boat or floating pontoon. Once Lake Cowal has sufficiently dried to allow construction activities, excavation would be conducted within the pipeline disturbance corridor and the pipeline placed within the excavated channel.

Potential adverse impacts from erosion on adjacent vegetation would be minimised by back filling the excavated channel as soon as practicable. If monthly visual inspections identify a risk on adjacent vegetation from erosion, corrective measures would be implemented (active revegetation or use of temporary sediment control structures).

Given the above, it was concluded the Modification would not substantially reduce the vegetation in the Lake Cowal/Wilbertray Wetland (Appendix C).

##### **Matters of National Environmental Significance**

An analysis of the nature and extent of the likely impacts of the Modification on all threatened species and communities listed under the EPBC Act which may be impacted is provided in Attachment A of Appendix C in accordance with the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (MNES) (DotE, 2013).

This assessment has been prepared in consideration of relevant Commonwealth guidelines and policy statements including listing advice, conservation advice, recovery plans and threat abatement plans. The *Species Profiles and Threats Database* (DEE, 2018b) was reviewed and considered.

Relevant EPBC Act listed threatened species and communities likely to be impacted by the Modification are:

- Grey Box EEC;
- Weeping Myall Woodlands EEC; and
- Superb Parrot.

These EPBC Act listed threatened species and communities are further discussed in Appendix C.

The impacts on MNES would be localised and negligible on a regional, state and national scale.

#### **Cumulative Impacts**

Prior to the CGO, the surrounding locality comprised cleared and semi-cleared farmland that was used for grazing of native and introduced pastures by livestock. Grazing and cropping remains the predominant land use in areas outside of ML 1535. The original native tree cover had largely been removed except for scattered individual trees and patches of remnant vegetation.

Since commencing operations, the CGO has resulted in the clearance of native vegetation and fauna habitat mostly within ML 1535. In addition to this vegetation clearing, the CGO has approximately 440 ha of biodiversity offsets which have already been established. The existing biodiversity offsets are comprised of two areas, both located less than 5 km from the CGO (i.e. the Northern Offset Area, [Offset Area 2] and Southern Offset Area, [Offset Area 1]) (Figure 4-5).

The potential cumulative impact on threatened species and communities has been considered in Appendix C. The change in potential cumulative impacts on threatened species and communities arising from the Modification is considered to be minimal due to the localised nature of the works compared to the wider distribution of the species (their habitats) and communities.

The Modification would result in the removal of 286.7 ha of native vegetation, of which most (91%) is derived grassland in low/moderate condition (i.e. due to past agricultural land use) (260.8 ha). The existing Biodiversity Offset Strategy for the CGO would be augmented with an additional Biodiversity Offset Strategy for the Modification to compensate for the loss (Section 4.3.4).

### **4.3.3 Mitigation Measures and Management**

#### ***Existing Mitigation Measures and Management***

Evolution implements the following environmental management plans and other documents (prepared in accordance with the Development Consent [DA 14/98] conditions) relevant to the management of flora and fauna at the approved CGO:

- FFMP;
- TSMP;
- RMP;
- SSMP;
- CWMP;
- LMP;
- AQMP; and
- BOMP.

A summary of the mitigation measures at the CGO (relevant to the Modification) are provided in Table 4-3.

#### ***Additional Mitigation Measures and Management***

Additional impact avoidance and mitigation measures associated with the Modification (in addition to those already implemented at the CGO [Table 4-3]) are summarised in Table 4-4.

### **4.3.4 Modification Biodiversity Offset Strategy**

The existing Biodiversity Offset Strategy for the CGO would be augmented with an additional Biodiversity Offset Strategy for the Modification to account for additional residual impacts on flora and fauna.

**Table 4-3  
Existing Biodiversity Impact Mitigation Measures at the CGO**

Measure	Description
<b>Rehabilitation</b>	
Revegetation of the post-mine landforms	<p>The RMP describes the rehabilitation objectives and strategies for the CGO. The 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.</p> <p>Surface development areas associated with the CGO are progressively rehabilitated and revegetated with species characteristic of native species endemic to the local area. Landforms are revegetated with selected species of native and/or endemic vegetation that are both suitable to the physiographic and hydrological features of each landform, and which expand the areas of remnant endemic vegetation that currently exist in the immediate region.</p> <p>Permanent monitoring plots within remnant and rehabilitation areas have been established throughout the CGO and are monitored annually.</p>
Rehabilitation of the approved TSFs	<p>The rehabilitation objectives for the approved TSFs are to:</p> <ul style="list-style-type: none"> <li>• establish permanently stable landforms;</li> <li>• during operations, stabilise batters so they provide minimal habitat value for bird life (i.e. rock mulch or pasture cover);</li> <li>• post-operations, to establish vegetative communities (including Eucalypt and Riverine Woodland species and understorey species such as Rush and pasture species) which are suited to the hydrological features and substrate materials of the landform; and</li> <li>• exclude grazing and agricultural production.</li> </ul>
<b>Vegetation Clearance</b>	
Delineation of disturbance area	Clearance activities are restricted to areas occupied by the mine activities, buildings and paved surface, and those necessary for fire control in accordance with the FFMP.
Pre-clearance surveys	Pre-clearance surveys are undertaken in areas that are approved to be cleared and consist of preliminary habitat assessment to identify any habitat features present and secondary habitat assessment which involves further surveys of areas deemed as potentially containing fauna habitat (i.e. trees with hollows, bat presence, etc.) in accordance with the FFMP.
Fauna management strategies	Involves management strategies to minimise the impact of clearing activities on resident fauna in the short-term (including capture and removal of animal[s] found during pre-clearance surveys to alternative suitable habitat) and minimise the loss of habitat in the long-term (including the placement of nesting boxes in suitable habitat for birds and arboreal mammals) in accordance with the FFMP.
Vegetation clearance procedure	Procedures to be employed upon tree felling include the salvage of habitat features (such as hollow branches) as well as the collection of seed where available in accordance with the FFMP.
<b>Specific Management Measures Applicable to Flora and Fauna</b>	
Vehicle speed limits and road signage	Speed limits are imposed on vehicles using roads and tracks within ML 1535 in accordance with the FFMP. Signposting has been installed to remind personnel of the danger of vehicles to wildlife in accordance with the FFMP.
Threatened Species Management	The TSMP was developed to minimise potential impacts of the approved CGO on threatened flora and fauna species known and/or considered possible to occur in the disturbance area and/or immediate surrounds. The TSMP includes provisions for targeted searches prior to construction and proposed mitigation measures where threatened flora or fauna species are found. The TSMP also includes management strategies prepared for threatened species which have been recorded in the course of targeted surveys or for which habitat resources typically associated with the lifecycle components of a threatened species have been identified.

**Table 4-3 (Continued)**  
**Existing Biodiversity Impact Mitigation Measures at the CGO**

Measure	Description
Mechanisms to keep fauna away from the TSFs	<p>Mechanisms have been developed to keep fauna away from the approved TSFs in accordance with the FFMP, and include:</p> <ul style="list-style-type: none"> <li>• minimising the area of open water in the TSFs;</li> <li>• fencing to prevent both medium and large terrestrial fauna terrestrial and amphibians, from entering the area;</li> <li>• making the area non-conducive to the establishment of wildlife habitats, as far as possible; and</li> <li>• use of current best practice methods for avifauna deterrence.</li> </ul>
Cyanide destruction process	<p>Cyanide levels in the aqueous component of the tailings slurry do not exceed: 20 mg/L CN<sub>WAD</sub> (90<sup>th</sup> percentile over six months) and 30 mg/L CN<sub>WAD</sub> (maximum permissible limit at any time), at the process plant. This level is in accordance with industry experience that indicates bird mortalities approach zero at levels of cyanide exposure below 50 mg/L CN<sub>WAD</sub>.</p>
Monitoring of fauna usage of the final void	<p>Post closure, a monitoring programme to monitor fauna usage of the final void at the approved CGO would be developed in accordance with the FFMP. The monitoring programme would be developed as a component of the long-term land use strategy in accordance with the FFMP.</p>
Monitoring of fauna usage of the tailings storage facilities	<p>The perimeter of the TSFs are patrolled once a day to observe and record fauna usage of the storages and whether deaths or other effects or incidents are occurring. Usage of the TSFs by bat fauna is also monitored.</p>
Remnant Vegetation Enhancement	<p>Four Remnant Vegetation Enhancement Areas have been established in accordance with the Remnant Vegetation Enhancement Programme (RVEP) (Figure 4-5) to improve the quality of habitat available to flora and fauna, expand the extent of remnant vegetation, increase the diversity and/or abundance of native flora and fauna within the enhancement areas and significantly contribute to the conservation of regional biodiversity.</p>
Protection of Remnant Vegetation within ML 1535	<p>Areas of woodland located near the western boundary of ML 1535 and near the southern boundary of ML 1535 were fenced and sign posted in 2005 and protected from disturbance in accordance with the FFMP.</p>
<b>General Management</b>	
Dust control	<p>The mitigation and management measures for windblown and mine generated dust at the approved CGO are presented in the AQMP. Control measures to suppress dust include watering disturbed surfaces.</p>
Noise management	<p>A range of noise control measures are implemented at the CGO to minimise noise emissions. Examples include the restriction of truck movements, adjustment of reversing alarms, scheduling the use of noisy equipment, directing noise emissions away from any sensitive areas and keeping equipment well maintained in accordance with the NMP.</p>
Blasting management	<p>A number of measures to minimise the impact of blasting activities are implemented at the approved CGO. These include eliminating secondary blasting, varying the direction of initiation, keeping face heights to a practical minimum, and exercising strict control over the burden, spacing and orientation of all blast drill holes in accordance with the BLMP.</p>
Bushfire management	<p>Bushfire management measures implemented at the CGO include the manipulation of fuel loads; works and fire fighting equipment on-site (including one emergency fire fighting unit); and provision of appropriate staff training (relating to bushfires).</p>
Pest (animal and vermin) control	<p>Pest control activities are implemented at the CGO in accordance with the FFMP and include: regular inspections to assess the status of pest populations within ML 1535 and Evolution-owned land; mandatory pest control for declared pests; and inspections to assess the effectiveness of control measures implemented and a review of these measures if necessary.</p>
Weed management	<p>Evolution currently manages weeds at the CGO to minimise the possibility of new weed incursion and controlling the spread of any existing noxious weeds within ML 1535 and Evolution-owned land in accordance with the FFMP.</p>

**Table 4-3 (Continued)**  
**Existing Biodiversity Impact Mitigation Measures at the CGO**

Measure	Description
Site water management	Measures have been developed for the CGO for the management and monitoring of surface water and groundwater quality and quantity within and around the mine site in accordance with the WMP. Management strategies to prevent the degradation of the quality of water in Lake Cowal during the mine operation phase include a variety of erosion, sediment and salinity control measures.

Source: After Appendix C.

**Table 4-4**  
**Additional Biodiversity Impact Avoidance and Mitigation Measures for the Modification**

Measure	Description
Design-Impact Avoidance	The relocated magazine and relocated explosives compound are positioned to avoid the need to clear the extant woodland vegetation (Weeping Myall Woodlands EEC) within ML 1535. The pipeline duplication is positioned to avoid the need to clear extant woodland vegetation (Weeping Myall Woodlands EEC) within road easements.
Revegetation of the post-mine landforms	The mine rehabilitation programme would aim to re-establish vegetation including the use of species characteristic of the Grey Box EEC and Weeping Myall Woodlands EEC listed under the EPBC Act.
Vegetation Clearance Protocol – Delineation of disturbance area	The area of Grey Box EEC and Weeping Myall Woodlands EEC listed under the EPBC Act within the mining lease areas would be shown on the future mine plans to reduce the risk of accidental clearance.
Fencing	Fencing would be installed either side of the re-aligned TSR consistent with the existing TSR. The purpose of the fencing is primarily to contain livestock which are periodically moved along the TSR.  The fencing along the TSR would also exclude livestock from the land between the re-aligned TSR and the proposed stockpile. There is approximately 55 ha of Grey Box EEC listed under the EPBC Act in this location mapped by AMBS (2018a) (Attachment A).
Seed Collection	Evolution has an existing seed collection programme that would be used to mitigate the loss of the Grey Box EEC listed under the EPBC Act. This would extend to collecting seed stock from species characteristic of the Grey Box EEC and Weeping Myall Woodlands EEC listed under the EPBC Act from areas to be cleared (where available).
Mechanisms to keep fauna away from tailings storage facilities	The following measures would be adopted relevant to making the IWL less conducive to the establishment of wildlife habitats: <ul style="list-style-type: none"> <li>• vegetation would be removed and topsoil stripped within the IWL during its construction;</li> <li>• the IWL floor would be contoured during its construction to reduce island formation and number of rainfall-derived ponds (where possible);</li> <li>• vegetation regrowth within the IWL prior to commencement and during tailings discharge would be managed by herbicide use;</li> <li>• following construction of the IWL, bare ground within the IWL would be covered with tailings as soon as practical using a low throughput tailings pipeline with moveable spigots to enable flexibility in direction and location of spigot discharge; and</li> <li>• if aquatic algae, vegetation or macroinvertebrate species are present in rainfall-derived ponds within the IWL, tailings discharge into rainfall-derived ponds would suppress unwanted habitat resources.</li> </ul>

Source: After Appendix C.

### **Existing Biodiversity Offset Strategy**

Evolution has two existing offset areas for the CGO. One offset area is located approximately 1 km north of ML 1535 (the Northern Offset Area [Offset Area 2]) and the other is located approximately 3 km south of ML 1535 (the Southern Offset Area [Offset Area 1]) (Figure 4-5). The CGO existing offset areas total approximately 440 ha.

The objectives for the CGO existing offset areas are to:

- secure the tenure of the offset areas for long-term conservation purposes (excluding the land within the ETL and gas pipeline easements);
- enhance flora and fauna habitats within the offset areas, including increasing the area of Myall Woodland EEC through regeneration and revegetation;
- establish native vegetation characteristic of a Eucalypt woodland in the previously cleared agricultural land within the Revegetation Area of the Southern Offset Area; and
- improve the flora value of the land in the CGO existing offset areas in the medium to long-term.

### **Approach for Selecting the Biodiversity Offset Area**

A biodiversity offset strategy has been prepared in accordance with the NSW Offset Policy (OEH, 2014a) and FBA (OEH, 2014b).

The NSW Offset Policy (OEH, 2014a) requires like-for-like offset outcomes which mean:

- species credit species must be offset with the same species credit species; and
- BVTs must be offset with closely related BVTs (BVTs able to be retired to address the Ecosystem Credit Requirements are listed in the credit report [Attachment G1-G4 of Appendix C] and re-stated in Table 4-5).

Evolution has elected to address the offset requirements by offsetting through four land based offset areas (Figures 4-5, 4-6a and 4-6b).

The *Biobanking Assessment Methodology* (OEH, 2014c) and The Credit Calculator were used to assess the biodiversity values of the land-based offset areas. AMBS (2018a) (Attachment A of Appendix C) undertook flora and fauna surveys and habitat assessments throughout the proposed offset areas.

### **Ecosystem Credits**

Table 4-5 provides a reconciliation of the ecosystem credits required, available and additional to that required for the Modification. The four offset areas satisfy the 3,687 credits required by the Credit Calculator.

Additionally, there are an excess of credits available within the offset areas (2,069 credits, Table 4-5). Under the NSW Biobanking Offset Scheme, the additional credits could be sold and/or used to offset a future development.

Ecosystem credits generated from the proposed offset areas (Figure 4-6a and 4-6b) would meet (and exceed) the credit requirements of the Modification.

Threatened ecological communities in the proposed offset areas are summarised in Table 4-6 (Figures 4-6a and 4-6b). Credits related to threatened ecological communities generated from the offset areas would satisfy, and exceed the credits required from the disturbance of the BAR Footprint.

### **Commonwealth Offset Requirements**

The bilateral agreement made under section 45 of the EPBC Act between the Commonwealth of Australia and the State of NSW relating to environmental assessment (the NSW Assessment Bilateral Agreement – dated 26 February 2015), enables the Commonwealth Minister for the Environment to rely on assessment processes of the State of NSW in assessing actions referred under the EPBC Act.

A reconciliation of the Biodiversity Offset Strategy against the Commonwealth offset principles (Commonwealth Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC], 2012) is presented in Table 4-7.

### **Management of the Proposed Biodiversity Offset Area**

The proposed offset areas would be managed according to the requirements in the agreement for long-term security. The biodiversity credit report for the proposed offset areas lists the following required management measures:

- excluding commercial apiaries;
- control of feral and/or over-abundant native herbivores; and
- maintenance of natural flow regimes.

**Table 4-5**  
**Reconciliation of the Ecosystem Credits Required, Available and Additional**

Biometric Vegetation Community (BVT)		Ecosystem Credits Required <sup>#</sup>	Ecosystem Credits Available	Additional Credits Not Required
1	Weeping Myall Open Woodland (LA 212)	109	305	196
2	Inland Grey Box - White Cypress Pine Woodland (LA 152)	816	1,895	1,079
3	River Red Gum Forest (LA 191)	19	292	273
4	Belah Woodland (LA 105)	193	714	521
5	Dwyer's Red Gum - White Cypress Pine - Currawang Woodland (LA 144)	18	18 <sup>A</sup>	-
6	Highly Modified Derived Grasslands (LA 138)	2,532	2,532 <sup>B</sup>	-
Total		<b>3,687</b>	<b>5,756</b>	<b>2,069<sup>*</sup></b>

\* Under the NSW Biobanking Offset Scheme, these additional credits could be sold and used to offset a different development.

<sup>A</sup> Credits from LA 148 as detailed in Appendix C.

<sup>B</sup> Includes credits from multiple BVTs as detailed in Appendix C, including 189 credits from Grey Box EEC listed under the EPBC Act and BC Act.

<sup>#</sup> Refer to Table 4-2.

**Table 4-6**  
**Threatened Ecological Communities in the Proposed Offset Areas**

Community	Offset Area	Listing	Area	Credits
Inland Grey Box - White Cypress Pine Woodland <sup>#</sup> (LA152)	6	BC Act	165.5	2,084
		EPBC Act		
Weeping Myall Open Woodland <sup>†</sup> (Derived Grassland in Moderate Condition) (LA212)	3	BC Act	20	305
		EPBC Act	1.5 <sup>^</sup>	~23 <sup>*</sup>

\* Calculated by dividing 305 credits by 20 ha (which equals 15.25 credits per ha) multiplied by 1.5 ha.

<sup>^</sup> There is also 18.5 ha of Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212) that currently does not meet the criteria for the Myall Woodland EEC listed under the EPBC Act, but is likely to in the future.

<sup>#</sup> Inland Grey Box - White Cypress Pine Woodland is listed as *Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Penepplain, Nandewar and Brigalow Belt South Bioregions* under the BC Act and *Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia* under the EPBC Act.

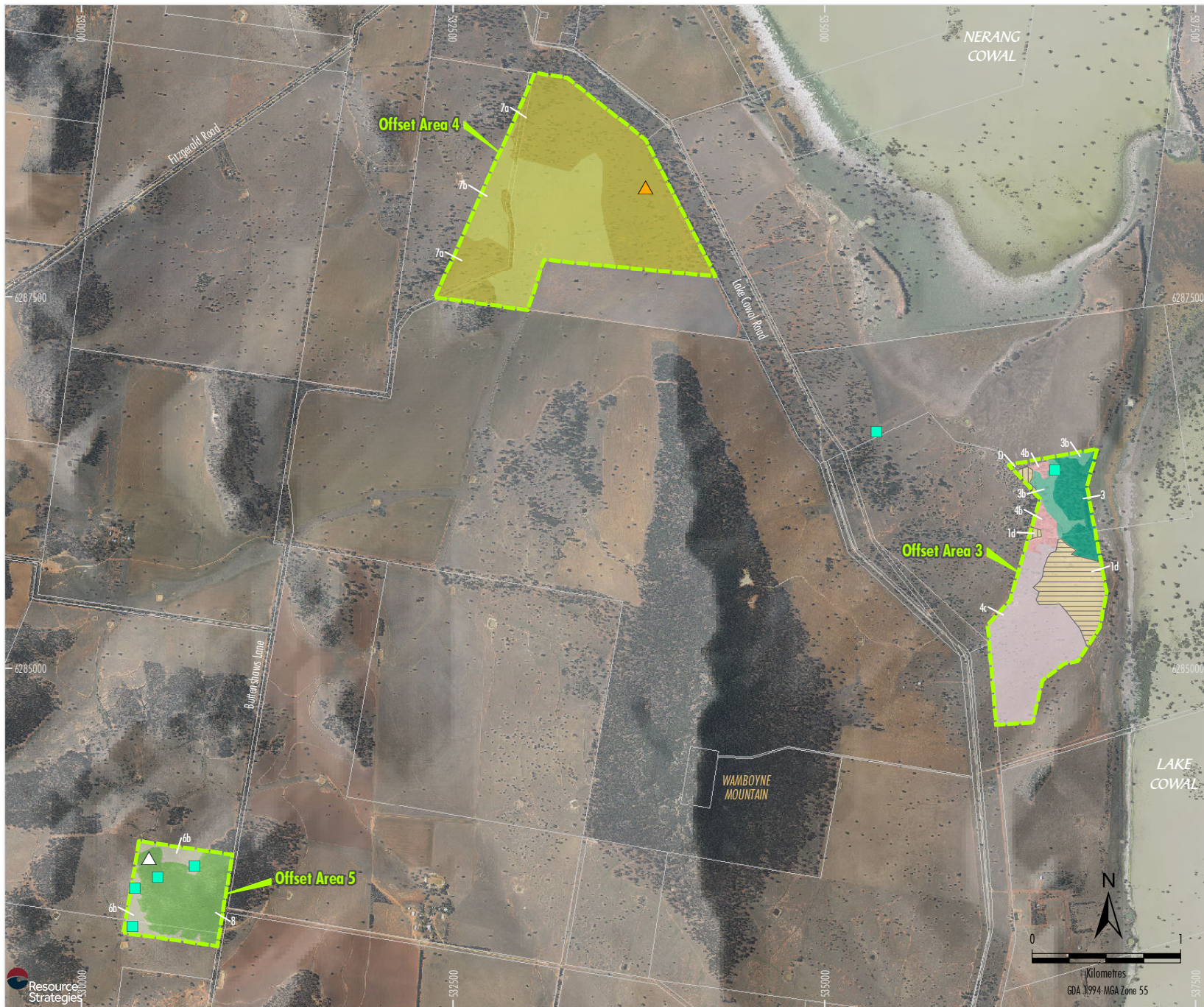
<sup>†</sup> Weeping Myall Open Woodland is listed as *Myall Woodland in the Darling Riverine Plains, Brigalow Belt South, Cobar Penepplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions* under the BC Act and *Weeping Myall Woodlands* under the EPBC Act.



**Table 4-7**  
**Reconciliation of the Biodiversity Offset Strategy against the Commonwealth Offset Principles**

Offset Principles	Elements of the Modification Offset that Address these Requirements
<i>Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environmental law and affected by the action.</i>	<p>The offsets directly contribute to the ongoing viability of the specific protected matter impacted i.e. 'like for like'.</p> <p>The residual impacts on EPBC Act listed threatened ecological communities (Grey Box EEC and Weeping Myall EEC) are offset with the same BVT (LA152 and LA212, respectively) which has been confirmed to meet the criteria for the EPBC Act listed threatened ecological communities.</p> <p>Impacts on potential breeding habitat for the Superb Parrot would be offset with conservation and management of similar habitat for the Superb Parrot (same BVT [LA191]).</p>
<i>Be built around direct offsets but may include other compensatory measures.</i>	Evolution has elected to address the offset requirements by offsetting through four additional land based offset areas Appendix C.
<i>Be in proportion to the level of statutory protection that applies to protected matters.</i>	<p>The NSW Offset Policy (OEH, 2014a), which was applied to the Modification, accounts for the level of statutory protection (vulnerable to critically endangered) of the relevant protected matters in calculating the offset requirement.</p> <p>The land-based offset areas would satisfy 100% of the offset requirements for each threatened species and community potentially impacted by the Modification.</p>
<i>Be of a size and scale proportionate to the impacts on the protected matter.</i>	The size and scale of the offset was determined using the NSW Offset Policy (OEH, 2014a). This takes into consideration specific attributes of the relevant protected matters and its habitat and the quality and importance of the habitat.
<i>Effectively account for and manage the risks of the offset not succeeding.</i>	The implementation of the offset strategy is likely to be a condition of CGO Development Consent (DA 14/98)
<i>Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs.</i>	The CGO implementation of the offset strategy is beyond existing requirements, in that it is not part of any private conservation reserve system. The enduring protection that would be applied to the biodiversity offset areas is new and additional under duty of care or any environmental planning laws.
<i>Be efficient, effective, transparent, proportionate, scientifically robust and reasonable.</i>	The size and scale of the offset was determined using the NSW Offset Policy (OEH, 2014a).
<i>Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.</i>	The proposed offset areas would be secured using an agreement between the Commonwealth Minister for the Environment and a landholder to permanently protect and manage an area of land.

<sup>1</sup> After DSEWPaC (2012).



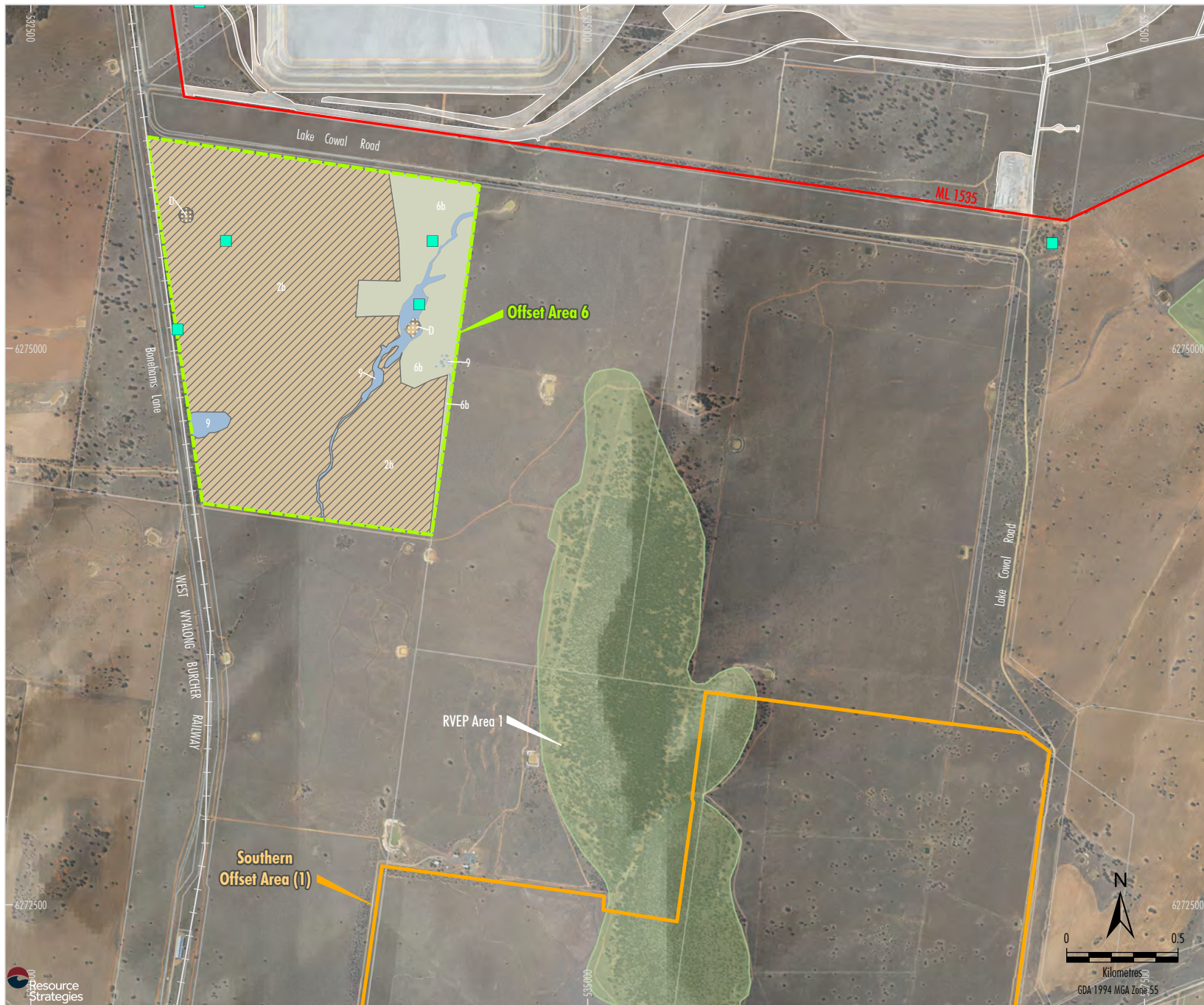
- LEGEND**
- Proposed Offset Area
  - Threatened Species Records**
  - Superb Parrot Recorded Location
  - ▲ *Austroriparia wakoalica*
  - Tylophora linearis*
  - Threatened Ecological Communities**
  - Weeping Myall Woodland EEC (BC Act and EPBC Act)
  - Weeping Myall Woodland EEC (BC Act)
  - VEGETATION MAPPING**
  - Semi-arid Woodlands (Grassy sub-formation) - Riverine Plain Woodlands**
  - 1d Weeping Myall Open Woodland (Derived Grassland in Moderate Condition) (LA212)
  - Forested Wetlands - Inland Riverine Forests**
  - 3 River Red Gum Forest (Moderate Condition) (LA191)
  - 3b River Red Gum Forest (Derived Grassland in Moderate Condition) (LA191)
  - Semi-arid Woodlands (Grassy sub-formation) - Northwest Floodplain Woodlands**
  - 4b Belah Woodland (Semi Cleared in Moderate Condition) (LA105)
  - 4c Belah Woodland (Derived Grassland in Moderate Condition) (LA105)
  - Grasslands - Western Slopes Grasslands**
  - 6b Highly Modified Derived Grasslands (Low Condition) (LA138)
  - Grassy Woodlands - Floodplain Transition Woodlands**
  - 7a Poplar Box - Belah Woodland (Semi Cleared in Moderate Condition) (LA175)
  - 7b Poplar Box - Belah Woodland (Derived Grassland in Moderate Condition) (LA175)
  - Semi-arid Woodland (Scrubby sub-formation) - Inland Rocky Hill Woodlands**
  - 8 Green Mallee - White Cypress Pine Woodland (Moderate Condition) (LA148)
  - Other Map Units**
  - D Cleared

Source: AMBS (2018); © NSW Department of Finance, Services & Innovation (2017)  
 Orthophoto: Evolution (Oct 2017)



**CGO PROCESSING RATE MODIFICATION**  
**Vegetation Communities**  
**- Proposed Biodiversity Offset Areas 3, 4, 5**

**Figure 4-6a**



- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Approximate Extent of Approved Surface Development
  - Remnant Vegetation Enhancement Program Area
  - Existing Offset Area
  - Proposed Offset Area
  - Threatened Species Records**
  - Superb Parrot Recorded Location
  - Threatened Ecological Communities**
  - Grey Box Woodland EEC (BC Act and EPBC Act)
  - VEGETATION MAPPING**
  - Grassy Woodlands - Floodplain Transition Woodlands**
  - 2b Inland Grey Box - Poplar Box - White Cypress Pine (Derived Grassland in Low Condition) (LA152)
  - 6b Grasslands - Western Slopes Grasslands
  - Highly Modified Derived Grasslands (Low Condition) (LA138)
  - Freshwater Wetlands - Inland Floodplain Swamps**
  - 9 Shallow freshwater mixed marsh sedgeland (Moderate Condition) (LA198)
  - Other Map Units**
  - D Cleared

Source: AMBS (2018); OEH (2017); Evolution (2018); © NSW Department of Planning and Environment (2017); Department of Finance, Services & Innovation (2017) Orthophoto: Evolution (Oct 2017)



**CGO PROCESSING RATE MODIFICATION**  
**Vegetation Communities**  
**- Proposed Biodiversity Offset Area 6**



**Figure 4-6b**

## 4.4 ABORIGINAL CULTURAL HERITAGE

An ACHA has been prepared for the Modification by Niche Environment and Heritage (2018) and is presented in Appendix D.

The ACHA has been undertaken in consideration of (but not limited to) the following guidelines, regulations and codes:

- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005);
- *Aboriginal cultural heritage consultation requirements for proponents 2010* (Consultation Guidelines) (DECCW, 2010a);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b);
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW, 2010c);
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011);
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites, 2013);
- *NSW Minerals Industry Due Diligence Code of Practice for the Protection of Aboriginal Objects* (NSW Minerals Council, 2010);
- *Engage Early – Guidance for proponents on best practice Indigenous engagement for environmental assessments* (Commonwealth Government, 2016); and
- *NSW National Parks and Wildlife Regulation, 2009* (NPW Regulation).

Section 4.4.1 describes the existing environment of Aboriginal cultural heritage within the Lake Cowal region, Section 4.4.2 assesses the potential impacts of the Modification on Aboriginal cultural heritage values and Section 4.4.3 describes mitigation and management measures.

### 4.4.1 Existing Environment

#### **Aboriginal History**

Lake Cowal sits in the Country of the Wiradjuri people. Wiradjuri was the largest language grouping in the area that is now NSW (Appendix D).

Wiradjuri regularly communicated, moved, traded and participated in ceremonies between their Country and neighbouring areas. Rather than being confined to strict 'tribal' boundaries, such as the borders that would be artificially imposed by European anthropologists, Wiradjuri family groups and clans would have interacted with neighbouring groups along both physical and social boundaries (Appendix D).

It is generally accepted that Aboriginal occupation of Australia dates back at least 45,000 years, and the Wiradjuri were likely present in the Lachlan and Lake Cowal area from the beginning of this time (Appendix D).

#### **Natural Resources**

The landscape of the Lake Cowal region is characterised by plains and low hills around the dominant landscape feature of Lake Cowal itself. Lake Cowal is an ephemeral, fresh water inland lake. Variable climatic conditions and the availability of water in the ephemeral system may have influenced the way Aboriginal people used and moved through the landscape over time.

Animal and plant resources provided food and materials to the local Aboriginal community. The distribution of people would have been affected by the distribution of animals and plants, and these factors are determined by climate, soil, topography and water.

Section 4.3 and Appendix C provide detailed information regarding the ecological attributes of the Modification area and surrounds.

#### **Aboriginal Cultural Heritage Management**

Evolution has obtained Permits and Consents under sections 87 and 90 of the *NSW National Parks and Wildlife Act, 1974* (NPW Act) for the management of Aboriginal heritage at the approved CGO. These Permits and Consents include the following:

- Permit 1468 authorising certain archaeological works in the ML 1535 area, water pipeline area and borefield area.
- Consent 1467 authorising the destruction of Aboriginal objects in the ML 1535 area, water pipeline area and borefield area.
- Permit 1681 authorising certain archaeological works in the road upgrade area and the relocated TSR.
- Consent 1680 authorising the destruction of Aboriginal objects in the road upgrade area and the relocated TSR.

Activities for the existing CGO have been generally conducted in accordance with relevant Permit and Consent conditions and the approved IACHMP.

### **Previous Archaeological Investigations**

A number of Aboriginal heritage surveys and assessments have previously been undertaken in the CGO area (including the Modification area) and surrounds, including the following:

- Paton (1989) *Preliminary Archaeological Inspection of Lake Cowal Mining Exploration Lease*.
- Cane (1995) *Camp sites at Lake Cowal: an archaeological survey in central New South Wales*.
- The EIS (North Limited, 1998).
- Pardoe (2009a) *Archaeological Investigations at Lake Cowal*.
- Pardoe (2009b) *Archaeological Excavations at Lake Cowal*.
- Pardoe (2013) *Cowal Gold Mine Extension Modification Aboriginal Cultural Heritage Assessment*.
- Pardoe (2015) *Summary of Stone Tools from Barrick Gold Mine*.
- Various due diligence style investigations and salvage activities (2005 to 2018).

In addition, a search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 24 August 2017 (Appendix D) for the ML 1535 area, the proposed MLA 1 area and the proposed pipeline duplication corridor and surrounds.

The extensive body of existing information and the results of the AHIMS database search assisted with providing a regional context for the assessment, and in developing a model of the likely archaeological and cultural significance of the Modification area (Appendix D).

### **Registered Sites**

The AHIMS results show that the majority of the sites recorded within or near ML 1535 are stone artefact concentrations or isolated artefacts (Appendix D).

The majority of the previously registered sites within ML 1535 have been the subject of management and mitigation measures, and as such have been managed (i.e. salvaged) in accordance with CGO Permits and Consents and the IACHMP. The remaining registered sites are not within the Modification area and would continue to be managed in accordance with the requirements of the relevant Permits and Consents.

### **Background Distribution**

Due to the comprehensive understanding of archaeology in the Lake Cowal region, it is possible to differentiate between unique sites and those sites that represent a component of the regional background distribution (Pardoe, 2013).

The background distribution evident at Lake Cowal consists mainly of lithic items found across the landscape at low densities. Comparatively, 'sites' generally consist of areas with both larger numbers and greater density of lithic items (Pardoe, 2009a).

A number of the background distribution lithic items within the CGO (including the Modification area) have been collected and are currently stored in a Temporary Keeping Place (i.e. they are no longer located *in situ*) in accordance with the relevant Permits and Consents.

The density of lithic items (consisting mainly of flakes and cores with a large amount of debitage) appears to be greatest between drainage lines. There are low-density areas apparent throughout the back plains micro-environment (as defined by Pardoe [2009a]). This includes portions of the Modification area and surrounds. The density of lithic items across the Modification area and surrounds is considered typical for the region, considering the extensive and continued Aboriginal occupation of the region (Pardoe, 2009a; Appendix D).

The disturbance of these background distribution lithic items has been previously assessed (e.g. within the *Cowal Gold Mine Extension Modification Environmental Assessment* [Barrick, 2011] [Extension Modification]) and approved by relevant Permits and Consents under the NPW Act. No further impact assessment is required for these items. The impact assessment undertaken for the Modification considers newly identified Aboriginal heritage sites only (Section 4.4.2 and Appendix D).

### Community Consultation

Consultation with the Aboriginal community regarding the Modification was undertaken in accordance with the Consultation Guidelines (DECCW, 2010a) and clause 80c of the NPW Regulation.

Table 4-8 summarises the main stages of the Aboriginal heritage consultation process undertaken as part of the Modification, with further detail provided in Section 4 of Appendix D.

### Survey Design

Aboriginal cultural heritage surveys were undertaken to identify any new sites and ground-truth and determine the visible extent of previously registered artefact scatter sites within the ML 1535 area and proposed MLA 1 area (the Subject area).

The surveys sampled the geographic extent of the Subject area, excluding the portion of the pipeline corridor within the lake bed of Lake Cowal which was inundated with water at the time (a total survey coverage of 95%).

### Archaeological Findings

During the surveys an additional 65 Aboriginal cultural heritage sites were identified within the Subject area. The most common site encountered during the survey was stone artefacts. Table 4-9 provides a summary of the types of artefacts/objects identified during the surveys.

**Table 4-9  
Sites Identified During Aboriginal Cultural  
Heritage Surveys**

Site Type	Number
<b>Stone Artefact(s) or Heat Retainer*</b>	
Artefact(s)	32
Heat Retainer	17
<b>Stone Artefact(s) and/or Heat Retainer and/or Oven*</b>	
Artefact(s)/Heat Retainer	10
Artefact(s)/Oven	1
Artefact(s)/Heat Retainer/Oven	1
Oven/Heat Retainer	2
Oven	1
<b>Scarred Tree*</b>	
Scarred Tree	1
<b>Total</b>	<b>65</b>

Source: After Appendix D.

\* Categories as per Figure 4-7.

The site types recorded were consistent with the previous findings in the vicinity of Lake Cowal. A detailed description of the sites identified during the surveys is provided in Appendix D. Figure 4-7 shows the sites that would be directly impacted within the Modification area in addition to sites that would not be impacted by the Modification.

### Archaeological and Cultural Heritage Values

The Aboriginal heritage sites recorded in the Subject area are predominantly of low scientific significance (88% of the total identified sites).

Three sites located within the Subject area are of relatively higher scientific significance (Appendix D):

- Lake Cowal 2017-057 [Artefact(s)/Oven/Heat Retainer];
- Lake Cowal 2017-036 [Artefact(s)/Heat Retainer]; and
- Lake Cowal 2017-023 [Artefact(s)].

Five sites located within the Subject area are of moderate scientific significance (Appendix D):

- Lake Cowal 2017-012 [Oven/Heat Retainer];
- Lake Cowal 2017-021 [Scarred Tree];
- Lake Cowal 2017-030 [Oven/Heat Retainer];
- Lake Cowal 2017-037 [Oven]; and
- Lake Cowal 2017-055 [Artefact(s)/Oven].

No Aboriginal sites within the Subject area or immediate surrounds are listed on the NSW State Heritage Register or the National Heritage List.

The RAPs were asked to contribute their cultural knowledge of the Subject area and the sites within it, at all stages during the consultation process (e.g. during the initial information session, as part of the review of the Proposed Methodology, during the field surveys, as part of the review of the draft ACHA and during the draft ACHA information session and site inspection). Comments received from RAPs in relation to the cultural significance of the Subject area and surrounds are detailed in Appendix D.

**Table 4-8  
Summary of Aboriginal Heritage Consultation Programme**

Date	Consultation Conducted
16 February 2017	Letters requesting the names of Aboriginal stakeholders that may have had an interest in the consultation process for the Modification were sent to the Office of the Registrar (NSW <i>Aboriginal Land Rights Act, 1983</i> ), Native Title Services Corporation Limited, National Native Title Tribunal, Dubbo OEH, Forbes Shire Council, Bland Shire Council, West Wyalong Local Aboriginal Land Council (LALC), Condobolin LALC and Central West Local Land Services to identify Aboriginal parties.
23 February to 6 March 2017	Responses to the above requests were received from the Bland Shire Council, Forbes Shire Council, National Native Title Tribunal, Dubbo OEH, Office of the Registrar (NSW <i>Aboriginal Land Rights Act, 1983</i> ) and West Wyalong LALC.
7 March 2017	Public advertisement published in the Forbes Advocate and West Wyalong Advocate inviting interested Aboriginal parties or groups to register an interest in the consultation process.
8 March 2017	Public advertisement published in the Condobolin Argus, Daily Liberal, Area News (Griffith), Daily Advertiser and Koori Mail inviting interested Aboriginal parties or groups to register an interest in the consultation process.
8 March 2017	Letters seeking registrations of interest were sent to Aboriginal parties or groups identified by the above step.
8 March 2017	Letters advising of automatic registration for the consultation process were sent to all existing RAPS who had previously registered an interest in the CGO.
March 2017	A total of 29 groups/individuals were registered as RAPS for the Modification.
24 March 2017	Provision of a Proposed Methodology for undertaking the ACHA to all RAPS for their review and comment. Letter included an invitation to attend an information session to discuss the Modification and the Proposed Methodology. Letter included request for cultural knowledge/significance of the area and/or known sites of Aboriginal heritage. Feedback was requested by 3 May 2017.
21 April 2017	Record of names of RAPS provided to OEH, the West Wyalong LALC and the Condobolin LALC in accordance with the Consultation Guidelines (DECCW, 2010a).
17 May 2017	Information session held at the Condobolin RSL for all RAPS. Included request for cultural knowledge/significance of the area and/or known sites of Aboriginal heritage.
29 May 2017	Provision of addendum to the Proposed Methodology to all RAPS to include an additional area to be investigated for the Modification, as well as a copy of the information session presentation, with feedback requested by 14 June 2017. In addition, survey engagement forms were distributed to all RAPS to assist in field survey selection process, with responses requested by 14 June 2017. The field survey participation selection process is described in detail in Appendix D.
May/June 2017	Feedback from the RAPS in regard to the Proposed Methodology and Proposed Methodology Addendum received and consideration given to all comments.
7 August to 11 August 2017, 30 August to 1 September 2017 and 20 December 2017	Aboriginal cultural heritage surveys were conducted by archaeologists from Niche Environment and Heritage accompanied by representatives from the RAPS. The cultural significance of the area and Aboriginal heritage sites were discussed with the attending RAPS.
16 February 2018	Draft ACHA issued to the RAPS for review, including survey results, archaeological and cultural significance assessment (based on feedback received during consultation and fieldwork), potential impacts and proposed mitigation and management measures. The letter specifically requested comments on cultural knowledge/significance and the proposed management measures, with feedback requested by 21 March 2018. Letter included an invitation to attend an information session on 8 March 2018 to discuss the findings, provide any information on cultural knowledge/significance, provide an opportunity to comment on the draft ACHA and to take part in a site inspection of a selection of identified Aboriginal heritage sites.
5 March 2018	Phone calls made to all RAPS to confirm attendance at the information session and site inspection, as well as to request comments (either verbal or written) on the draft ACHA.
8 March 2018	Information session held and opportunity for site inspection provided.
March 2018	Comments received from RAPS on the draft ACHA were considered and addressed in the final ACHA.

Source: After Appendix D.



- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application Boundary (MLA 1)
  - Approximate Extent of Approved Surface Development
  - Approximate Extent of Additional Modification Surface Disturbance
  - Modification Component
  - Aboriginal Heritage Sites
  - Stone Artefact(s) or Heat Retainer
  - Stone Artefact(s) and/or Heat Retainer and/or Oven
  - Scarred Tree

Note: Only sites of high or moderate significance have been labelled on this figure. The prefix "Lake Cowal 2017-0" has not been shown for each site name.

Source: Niche (2017); Evolution (2018); © NSW Department of Finance, Services & Innovation (2017)  
 Orthophoto: Evolution (Oct 2017)



**CGO PROCESSING RATE MODIFICATION**  
**Aboriginal Heritage Sites**  
**within ML 1535, MLA 1 and Surrounds**

**Figure 4-7**



#### 4.4.2 Potential Impacts

##### **Avoidance and Minimisation of Impacts**

The preliminary results of the ACHA were used in the design of the surface infrastructure, with sites avoided wherever possible.

During detailed design of surface infrastructure, further consideration will be given to the location of identified sites, to avoid and minimise potential impacts to Aboriginal cultural heritage where possible. Practical measures such as temporary fencing may be used to assist with site avoidance if considered necessary.

##### **Potential Direct Impacts**

Notwithstanding, the Modification would directly and indirectly impact the Aboriginal cultural heritage of the Subject area due to the direct disturbance of land within ML 1535, the proposed MLA 1 area and within the existing pipeline corridor (Appendix D).

Although the Modification would directly harm 22 sites and has the potential to indirectly harm 5 sites, it is anticipated that it would cause no harm to 38 sites. While sites that are expected to be harmed may be avoided during the detailed design phase of the surface infrastructure, it has been conservatively assumed that they would be impacted for the purposes of this assessment (e.g. through placement of the final alignment of the pipeline).

The existing Permits and Consents allow for the disturbance of all sites within ML 1535 and associated with the operation of the water supply pipeline. A new Aboriginal Heritage Impact Permit (AHIP) (and/or a variation to an existing Permits/Consents) would be applied for as part of the Modification for the proposed MLA 1 area.

##### **Potential Cumulative Impacts**

The potential cumulative impacts of the Modification are considered to be minor. Although there would be direct harm to a number of sites, most are of low scientific significance and comprise the background scatter of artefacts in the region and the existing Permits and Consents allow for their disturbance (excluding those within MLA 1) (Appendix D).

#### 4.4.3 Mitigation Measures and Management

The management of Aboriginal heritage sites located within the Subject area would be undertaken consistent with the requirements of the relevant CGO Permits and Consents and the approved IACHMP including for any previously unrecorded Aboriginal heritage sites.

A new AHIP (and/or a variation to existing Permits/Consents) would be sought as part of the Modification for the proposed MLA 1 area. The IACHMP would be updated to include the Modification, as necessary.

Recommendations for Aboriginal heritage management have been developed in consultation with the RAPs and would be undertaken for the Modification (Appendix D). These recommendations are as follows:

- Salvage excavation of known oven sites to collect dating samples prior to disturbance (i.e. Lake Cowal 2017-057, Lake Cowal 2017-030, Lake Cowal 2017-012, Lake Cowal 2017-055 and Lake Cowal 2017-037).
- Salvage excavation of sites Lake Cowal 2017-023 (if required, otherwise avoidance) and Lake Cowal 2017-036 prior to any further disturbance.
- Surface collection of visible artefacts at known sites prior to any surface disturbance, if required, otherwise avoidance.
- Existing management measures currently employed at the CGO would continue to be implemented for the Modification (e.g. for existing sites such as Site H).
- The background distribution of artefactual material would be managed in accordance with the requirements of the relevant Permits and Consents and the approved IACHMP.
- Items collected would be analysed consistent with current requirements and protocols.
- In the unlikely event that human skeletal remains are identified during the life of the CGO (incorporating the Modification), ground disturbance works in the vicinity of the human skeletal remains would cease immediately and the discovery immediately reported to the NSW Police. If it is suspected that the remains may be of Aboriginal origin then this would also be reported to the NSW Police. Evolution would then contact the OEH and representatives of the Aboriginal community. Work would not recommence in the location of the remains unless authorised in writing by the OEH.
- Evolution would continue to allow access to the Temporary Keeping Place for all RAPs, consistent with the protocols in the currently approved IACHMP.
- Evolution would continue to involve the RAPs in relevant matters regarding the Modification and the CGO.

## 4.5 NOISE

A Noise and Blasting Assessment for the Modification was undertaken by Renzo Tonin & Associates (2018) (Appendix E).

The operational noise assessment was conducted in accordance with the NSW *Industrial Noise Policy* (INP) (EPA, 2000).

In October 2017 the *Noise Policy for Industry* (EPA, 2017a) was released, which replaces the INP. Under the *Implementation and transitional arrangement for the Noise Policy for Industry (2017)* (EPA, 2017b), the INP continues to be applicable for the assessment of an application under certain circumstances.

As the SEARs for the Modification refer to the INP, the assessment was conducted in accordance with this policy rather than the *Noise Policy for Industry* (EPA, 2017a).

A description of the existing noise environment of the CGO is provided in Section 4.5.1. Section 4.5.2 describes the potential impacts of the Modification. Section 4.5.3 outlines proposed mitigation, management and monitoring. Potential blasting impacts of the Modification are described in Section 4.11.2.

### 4.5.1 Existing Environment

#### **Previous Assessment**

A Noise and Blasting Assessment of the currently approved CGO was undertaken by Renzo Tonin & Associates for the Mine Life Modification (Renzo Tonin & Associates, 2016).

Noise modelling conducted for the Mine Life Modification indicated 10 privately-owned receivers would experience noise levels above the project-specific noise level (PSNL) of 35 A-weighted decibels (dBA) equivalent continuous noise level ( $L_{Aeq(15 \text{ minute})}$ ). This included five receivers in the noise management zone (i.e. 3 to 5 dB above the PSNL) and two receivers in the noise affectation zone (>5 dB above the PSNL).

The existing CGO Development Consent (DA 14/98) criteria are provided in Table 4-10, along with the predicted intrusive noise levels at privately-owned receivers for the Modification.

The exceedances of the PSNL were approved for the CGO, subject to the management, mitigation and monitoring of potential noise impacts in accordance with the requirements of CGO Development Consent (DA 14/98). This includes:

- Development Consent noise limits for privately-owned receivers (Condition 6.4[c] of Schedule 2 of the CGO Development Consent [DA 14/98]);
- the right to request property acquisition for two receivers, in accordance with the requirements of Condition 6.4(a) of Schedule 2 of the CGO Development Consent (DA 14/98); and
- the right to request additional mitigation measures for some receivers, in accordance with the requirements of Condition 6.4(b) of Schedule 2 of the CGO Development Consent (DA 14/98).

#### **Noise Management and Monitoring**

Existing noise management and monitoring measures are described in the currently approved NMP and EPL 11912.

The existing monitoring programme includes operator-attended monitoring at locations representative of six privately-owned dwelling locations and two reference locations (i.e. at the New Lake Foreshore within ML 1535 and on Evolution-owned land, south of ML 1535) (Figure 2-3). The existing monitoring programme also assesses data from an on-site Automatic Weather Station and sample temperature gradient measurements coinciding with winter season noise surveys.

Based on the results of operator-attended monitoring, intrusive noise levels from the CGO were determined to be in accordance with Development Consent (DA 14/98) noise limits for the period January 2013 to September 2017 (Appendix E).

#### **Complaints**

No noise-related complaints have been received from the date of submission of the Mine Life Modification in November 2016 to January 2018 (Appendix E).

**Table 4-10**  
**Predicted Intrusive Noise Levels for the Currently Approved CGO and for the Modification**

Receiver	Receiver ID	Approved CGO	The Modification <sup>1</sup>
		(dBA L <sub>Aeq(15 minute)</sub> )	
Bramboyne	20	38 <sup>6</sup>	35
Caloola II	90b <sup>7</sup>	38 <sup>6</sup>	-
Foxman Downs II <sup>2</sup>	49b	37 <sup>6</sup>	36
Gumbelah <sup>3</sup>	38	35	34
Lakeview	22a	37 <sup>6</sup>	36
Lakeview II	22b	37 <sup>6</sup>	35
Lakeview III <sup>4</sup>	22c	39 <sup>6</sup>	38
Laurel Park <sup>3</sup>	15	39 <sup>6</sup>	35
The Glen	36a	38 <sup>6</sup>	37
Westella <sup>5</sup>	21	-	44
Westlea	42	-	46
All other receivers	-	35	35 or less

Source: After Appendix E.

Notes: Refer to the noise contour diagrams presented in Section 4.5.2 for receiver locations.

**Receiver in the Noise Management Zone.** **Receiver in the Noise Affection Zone.**

<sup>1</sup> Maximum predicted noise level – all scenarios.

<sup>2</sup> Formerly known as Foxham Downs II.

<sup>3</sup> Evolution has a noise agreement in place with the owner of this property.

<sup>4</sup> Formerly known as Westella.

<sup>5</sup> Formerly known as McLintock.

<sup>6</sup> CGO Development Consent (DA14/98) Noise Impact Assessment Criteria.

<sup>7</sup> It is noted that no dwelling is present at the location of the previously identified receiver known as 'Caloola II' or dwelling ID 90b. The owner of the property has confirmed that no habitable building is present. The dwelling ID for the receiver known as 'Caloola' has therefore changed from 90a to 90.

#### 4.5.2 Potential Impacts

Renzo Tonin & Associates (2018) has conducted predictive noise modelling to determine potential noise impacts associated with the Modification (Appendix E).

The noise modelling methodology is based on previous predictive noise modelling conducted for the CGO (e.g. for the Mine Life Modification), with revisions as required to account for the Modification (Appendix E).

##### Operational Noise Criteria

The INP (EPA, 2000) prescribes detailed calculation routines for establishing project-specific L<sub>Aeq(15 minute)</sub> intrusive criteria and L<sub>Aeq(period)</sub> amenity criteria.

The INP project-specific intrusive and amenity assessment criteria for the Modification (i.e. PSNLs) are presented in Table 4-11. Intrusive criteria are applied on a project-only basis whilst amenity criteria are applied cumulatively with other industrial sources.

In those cases where the INP project-specific assessment criteria are exceeded, it does not automatically follow that all people exposed to the noise would find the noise noticeable or unacceptable.

The NSW Government (2014) *Voluntary Land Acquisition and Mitigation Policy For State Significant Mining, Petroleum and Extractive Industry Developments* (NSW Voluntary Land Acquisition and Mitigation Policy) provides some useful context in regard to characterising the practical implications of exceedances of the INP criteria (Table 4-12).

For the purposes of assessing potential noise impacts consistent with the NSW Voluntary Land Acquisition and Mitigation Policy, exceedances can be separated into a Noise Management Zone (i.e. marginal or moderate impacts of 3 to 5 dBA above the criteria) and a Noise Affection Zone (i.e. greater than 5 dBA above the criteria, with impacts considered to be significant) (Table 4-12).

Table 4-12 presents the methodology used for assessing operational noise against the INP project-specific noise assessment criteria.

**Table 4-11**  
**INP Project-specific Intrusive and Amenity Assessment Criteria (dBA)**

Receiver	Intrusiveness Criteria $L_{Aeq(15\text{ minute})}$			Amenity Criteria $L_{Aeq(\text{period})}$		
	Day	Evening	Night	Day	Evening	Night
All residential receivers	35	35	35	50	45	40
Relocated Crown Reserve	-	-	-	50 when in use		

Source: After Appendix E.

Note: Day 7.00 am to 6.00 pm, Evening 6.00 pm to 10.00 pm, Night 10.00 pm to 7.00 am.

**Table 4-12**  
**Characterisation of the Significance of Noise Impacts and Potential Treatments**

Residual Noise Exceeds INP Criteria by:	Characterisation of Significance of Residual Impacts	Potential Treatments
0 to 2 dBA above the PSNL	Impacts are considered to be <b>negligible</b>	The exceedances would not be discernible by the average listener and therefore would not warrant receiver based treatments or controls.
3 to 5 dBA above the PSNL in the INP <u>but</u> the development would contribute less than 1 dB to the total industrial noise level	Impacts are considered to be <b>marginal</b>	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
3 to 5 dBA above the PSNL in the INP <u>and</u> the development would contribute more than 1 dB to the total industrial noise level	Impacts are considered to be <b>moderate</b>	As for marginal impacts but also upgraded facade elements like windows, doors, roof insulation etc. to further increase the ability of the building facade to reduce noise levels.
>5 dBA above the PSNL in the INP	Impacts are considered to be <b>significant</b>	Provide mitigation as for moderate impacts and see voluntary land acquisition provisions.

Source: After NSW Government (2014).

### **Construction Noise Criteria**

Noise generated by construction activities associated with linear infrastructure remote from mining activities at the CGO (e.g. construction of the water pipeline and Lake Cowal Road relocation) would be distinct local construction noise sources (Appendix E).

The assessment of construction noise associated with these activities has therefore adopted the construction noise management levels described in the *Interim Construction Noise Guideline* (ICNG) (NSW Department of Environment and Climate Change [DECC], 2009) (Appendix E). The ICNG construction noise management levels are provided in Table 4-13.

Construction of the Lake Cowal Road relocation and water pipeline would be conducted within the ICNG's recommended standard hours, except the portion of the water pipeline on the western side of Lake Cowal.

Given the proximity of this portion of the pipeline to the CGO and distance to sensitive receivers, construction of this portion of the pipeline would be undertaken outside of the ICNG's recommended standard hours (i.e. up to 24 hours per day, seven days per week in line with the operational hours of the approved CGO) (Appendix E).

### **Noise Modelling Methodology**

#### *Assessable Meteorological Conditions*

Assessable meteorological conditions for the Modification have been determined in accordance with the requirements of the INP based on available meteorological data (including temperature gradient measurements) from 2010 to 2013, to be consistent with the meteorology used for the Extension Modification and Mine Life Modification assessments (Appendix E).

Prevailing winds were not determined to be a feature of any season during the daytime, evening or night, and therefore, wind effects are not considered to be relevant assessable meteorological conditions (Appendix E).

**Table 4-13  
Construction Noise Guideline Noise Management Levels**

Time of Day	Management Level $L_{Aeq(15min)}$	How to Apply
<b>Recommended standard hours:</b>  Monday to Friday 7.00 am to 6.00 pm  Saturday 8.00 am to 1.00 pm  No work on Sundays or public holidays	Noise affected RBL + 10 dBA	<p>The noise affected level represents the point above which there may be some community reaction to noise:</p> <ul style="list-style-type: none"> <li>Where the predicted or measured <math>L_{Aeq(15min)}</math> is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affect level.</li> <li>The proponent should also inform all potentially impacted residents of the nature of the works to be carried out, the expected noise levels and duration, as well as contact details.</li> </ul>
	Highly noise affected 75 dBA	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise:</p> <ul style="list-style-type: none"> <li>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> <li>Times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences).</li> <li>If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol> </li> </ul>
<b>Outside recommended standard hours</b>	Noise affected RBL + 5 dBA	<ul style="list-style-type: none"> <li>A strong justification would typically be required for works outside the recommended standard hours.</li> <li>The proponent should apply all feasible and reasonable work practices to meet the noise affected level.</li> <li>Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community.</li> </ul>

Source: After DECC (2009).

Strong temperature inversions up to 8 degrees Celsius ( $^{\circ}\text{C}$ )/100 m were determined to be assessable meteorological conditions (Appendix E).

The assessable meteorological conditions for the Modification (i.e. strong temperature inversions) are consistent with those for previous noise assessments for the CGO (Appendix E).

#### Modelling Scenarios

Renzo Tonin & Associates (2018) modelled two key scenarios representing mining operations in Year 16 (2020) and Year 20 (2024) to assess potential noise impacts associated with the Modification.

Year 16 (2020) was selected as it is the year with the highest combined material movement (i.e. ore and waste rock), with the maximum mobile fleet in operation (Appendix E).

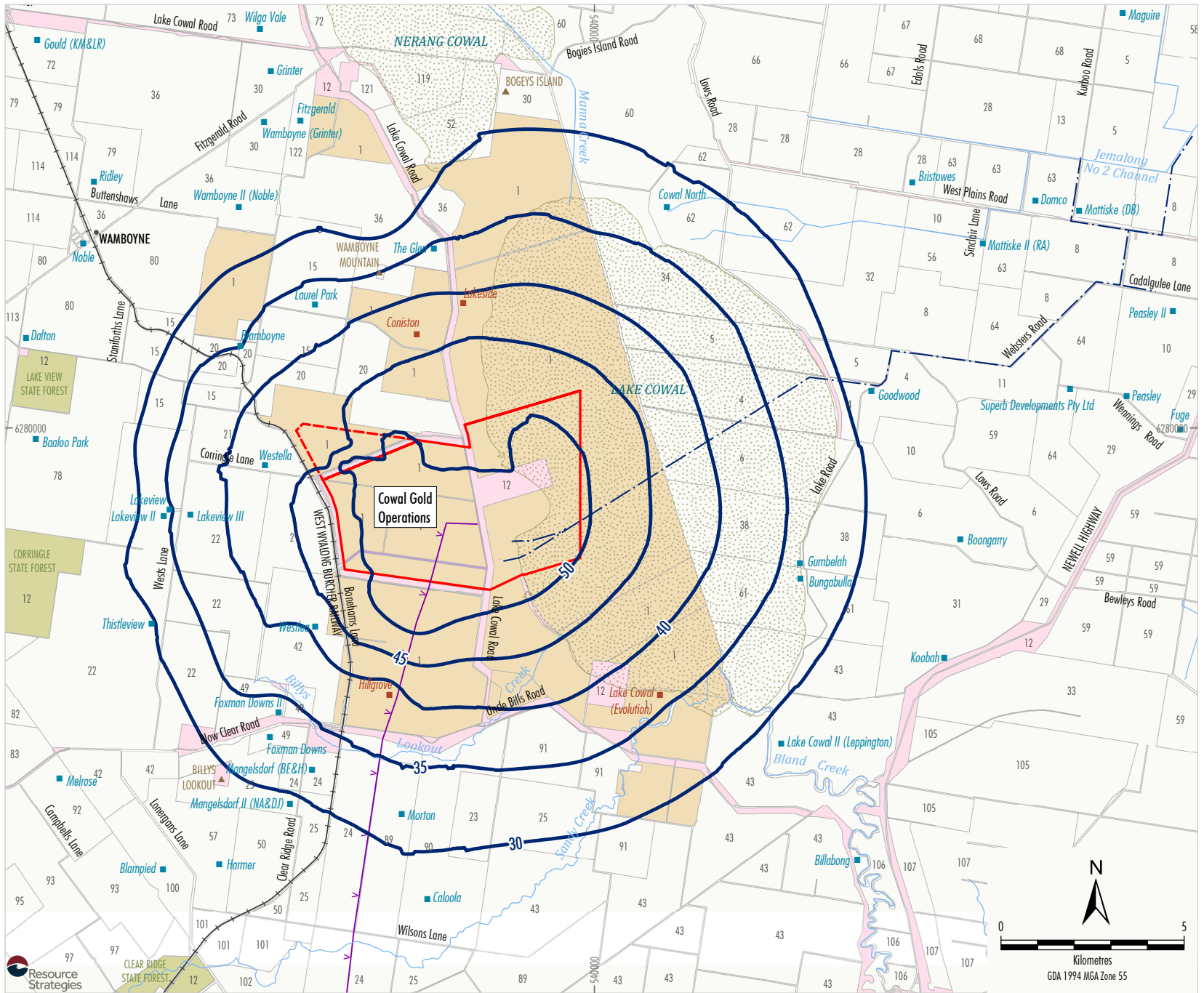
Year 20 (2024) was selected as it is when the IWL is developed to its maximum height (Appendix E).

For both 2020 and 2024, mining operations were modelled as occurring 24 hours per day, with the exception of tailings lift construction and some aspects of IWL development (e.g. soil stripping activities), which would occur during daytime only (7.00 am to 6.00 pm).

#### Potential Impacts (Intrusive)

Maximum predicted intrusive noise levels under assessable meteorological conditions for the Modification are presented in Table 4-10. Noise contours for the Modification are presented in Figures 4-8a and 4-8b for 2020 and 2024, respectively.

Noise levels for the Modification are predicted to comply with relevant PSNLs at all privately-owned receivers, with the exception of four receivers on three properties (i.e. excluding the two receivers currently in the Noise Affection Zone) (Table 4-10) (Appendix E).



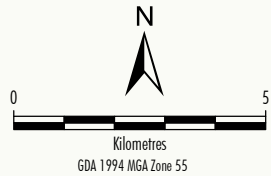
- LEGEND**
- Mining Lease Boundary (ML 1535)
  - Mining Lease Application (MLA 1)
  - Evolution Mining (Cowal) Pty Limited
  - Crown Land
  - Local Government
  - Private Landholder
  - State Forest
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - Railway
  - Electricity Transmission Line
  - Pipeline
  - Noise Contour ( $L_{Aeq}$  (15 minute) dBA)

Refer to Figure 1-3b for Landholder Key

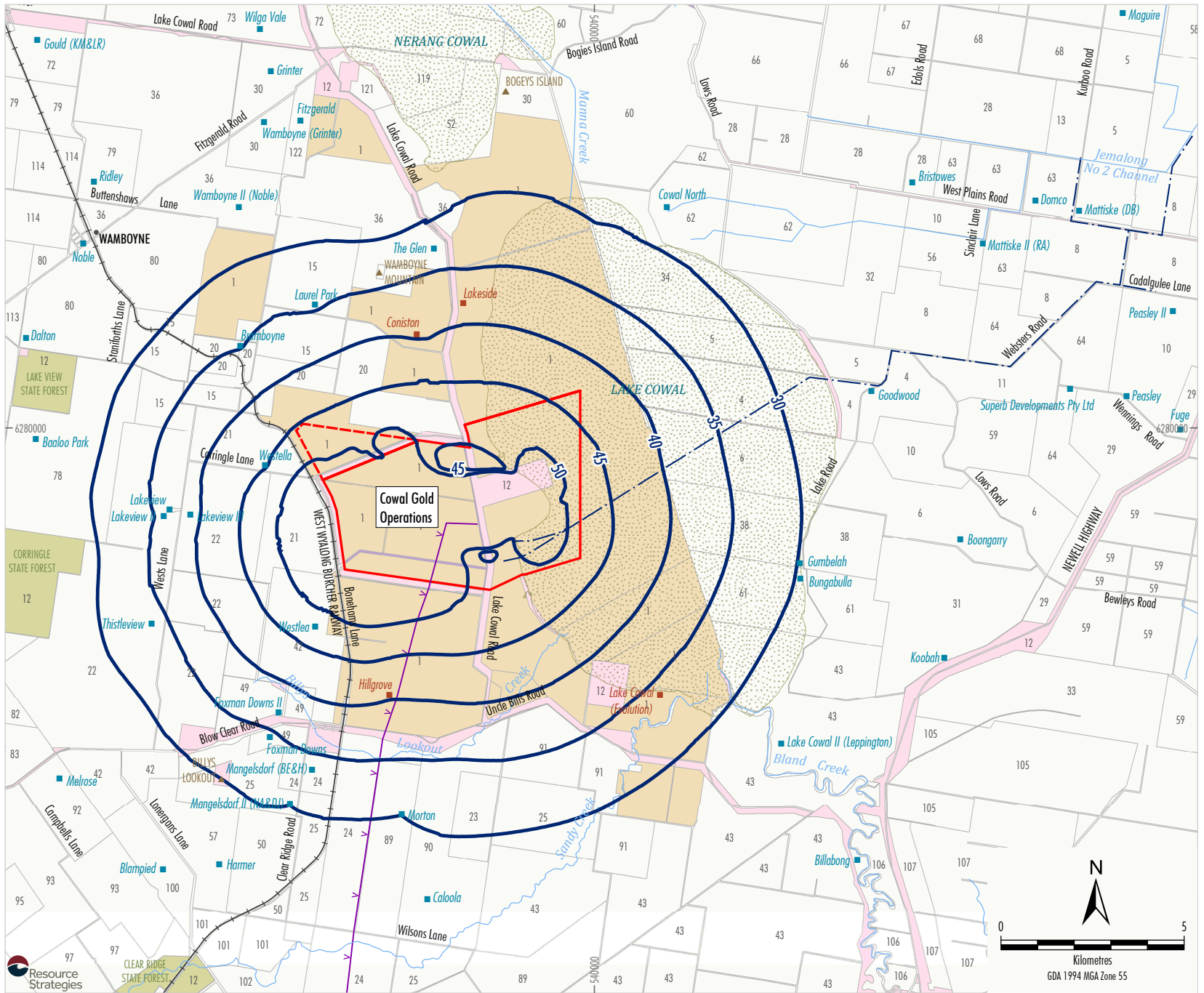
Source: Renzo Tonin (2018); Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**Operational Noise Contours - 2020**



**Figure 4-8a**



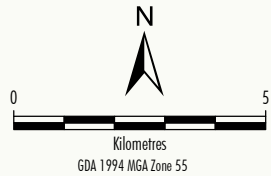
- LEGEND**
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  - Mining Lease Application (MLA 1)
  - Evolution Mining (Cowl) Pty Limited
  - Crown Land
  - Local Government
  - Private Landholder
  - State Forest
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - Railway
  - Electricity Transmission Line
  - Pipeline
  - Noise Contour ( $L_{Aeq}$  (15 minute) dBA)

Refer to Figure 1-3b for Landholder Key

Source: Renzo Tonin (2018); Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**Operational Noise Contours - 2024**



**Figure 4-8b**

However, noise levels for the Modification are predicted to comply with relevant CGO Development Consent (DA 14/98) noise limits at all privately-owned receivers (i.e. excluding the two receivers currently in the Noise Affection Zone) (Table 4-10) (Appendix E).

Two privately-owned receivers (Westella [formerly McLintock] and Westlea) are in the Noise Affection Zone for the approved CGO (Table 4-14).

Based on predicted noise levels for the Modification, Westella and Westlea would remain in the Noise Affection Zone (Table 4-14) for the CGO incorporating the Modification.

Five privately-owned receivers were identified as being in the Noise Management Zone for the approved CGO (Table 4-14).

Based on predicted noise impacts for the Modification, only Lakeview III would remain in the Noise Management Zone (Table 4-14) for the CGO incorporating the Modification.

In summary, based on maximum predicted intrusive noise levels under assessable meteorological conditions for the Modification, it is predicted that (Table 4-14):

- two privately-owned receivers would be within the Noise Affection Zone; and
- one privately-owned receiver would be within the Noise Management Zone.

#### **Potential Impacts (Amenity)**

Renzo Tonin & Associates (2018) assessed the INP amenity criteria at privately-owned receivers and the Relocated Crown Reserve. No exceedances of the project-specific amenity criteria were predicted (Appendix E).

#### **Potential Impacts (Sleep Disturbance)**

Appendix E also presents an assessment of potential sleep disturbance impacts. A sleep disturbance screening criterion (1% exceedance noise level [ $L_{A1(1 \text{ minute})}$ ]) of 15 dBA above the Rating Background Level has been adopted by the EPA. The sleep disturbance screening criterion for the Modification is therefore a  $L_{A1(1 \text{ minute})}$  of 45 dBA. An upper limit criterion of 65 dBA has also been adopted for the assessment (Appendix E).

Two privately-owned receivers (Westella and Westlea) were predicted to exceed the screening criterion, however in each case the upper limit criterion was not predicted to be exceeded (Appendix E). It is noted that these receivers are in the Noise Affection Zone (Table 4-14).

#### **Land Assessment**

The Voluntary Land Acquisition and Mitigation Policy applies where:

*The noise generated by the development would contribute to exceedances of the recommended maximum noise levels in Table 2.1 of the INP on more than 25% of any privately owned land where there is an existing dwelling or where a dwelling could be built under existing planning controls.*

Renzo Tonin & Associates (2018) determined the recommended maximum noise levels (night - 45 dBA  $L_{Aeq(Period)}$ ) would not be exceeded on more than 25% of any privately-owned land (contiguous lots owned by the same landowner) not in the Noise Affection Zone (Appendix E).

#### **Consideration of Reasonable and Feasible Mitigation Options**

Noise modelling conducted by SLR Consulting (2013) for the Extension Modification assessed the effectiveness of:

- noise bunds to shield mobile equipment operating on the waste rock emplacements during adverse weather; and
- locating mobile equipment on the eastern side of the waste rock emplacements (i.e. away from the closest receivers to the west of the CGO) during adverse weather conditions.

The noise modelling indicated that while these measures would reduce noise levels, the predicted reductions during adverse weather conditions were very limited (SLR Consulting, 2013).

SLR Consulting (2013) also assessed the effectiveness of scheduling the TSF lift works during the daytime only. As this was shown to appreciably reduce predicted evening and night-time noise levels at privately-owned receivers, undertaking TSF lift works during the daytime only was incorporated into the predictive modelling for the Extension Modification and Mine Life Modification. This measure has also been incorporated into the predictive modelling for the Modification (for TSF lifts and some aspects of IWL development [e.g. soil stripping activities]) (Appendix E).



**Table 4-14**  
**Summary of Privately-owned Receivers in the Noise Management and Noise Affection Zones**

<b>Zone</b>	<b>Approved CGO</b>	<b>The Modification</b>
Noise Affection Zone (>5 dBA above PSNL)	Westella <sup>1</sup> , Westlea (2)	Westella <sup>1</sup> , Westlea (2)
Noise Management Zone (3 to 5 dB above PSNL)	Bramboyne, Caloola II <sup>2</sup> , Lakeview III <sup>4</sup> , Laurel Park <sup>3</sup> , The Glen (5)	Lakeview III (1)

Source: After Appendix E.

Notes: Refer to Figures 4-8a and 4-8b for receiver locations.

Values in parentheses represent the numbers of privately-owned receivers in each zone.

<sup>1</sup> Formerly known as McLintock.

<sup>2</sup> It is noted that following investigation, no dwelling appears to be present at the location of the previously identified receiver known as 'Caloola II' or dwelling ID 90b. The owner of the property has confirmed that no habitable building is present.

<sup>3</sup> Evolution has a noise agreement in place with the owner of this property.

<sup>4</sup> Formerly known as Westella.

The existing CGO mobile equipment fleet would continue to be operated for the Modification.

Evolution has investigated retrofitting the existing haul truck fleet with noise attenuation kits, however the expected capital cost for this is not considered to be reasonable given the haulage fleet would be progressively decommissioned up until the cessation of open pit mining in approximately Year 20 (2024) and the limited number of privately-owned receivers predicted to experience exceedances of the relevant criteria.

Ongoing operational costs associated with maintaining the effectiveness of the noise attenuation would be additional to this capital cost.

A summary of the consideration of reasonable and feasible mitigation options against the NSW Voluntary Land Acquisition and Mitigation Policy is provided in Table 4-15.

### **Construction Noise**

Renzo Tonin & Associates (2018) determined the minimum distances from each construction activity (i.e. pipeline duplication or Lake Cowal Road relocation) to the nearest receivers that would result in compliance with the noise management levels described in the ICNG (Appendix E).

The analysis indicated that for construction of the water pipeline on the eastern side of Lake Cowal (i.e. during ICNG recommended standard hours only), one privately-owned dwelling (Goodwood [4]) is within the calculated minimum distance and would therefore be expected to receive noise levels above the ICNG 'Noise affected' noise management level (Appendix E).

For pipeline construction on the western side of Lake Cowal undertaken outside of the ICNG's recommended standard hours, no receivers are predicted to exceed the ICNG 'Noise affected' noise management level (Appendix E).

The analysis indicated that for construction of the Lake Cowal Road relocation (i.e. during ICNG recommended standard hours only), one privately-owned dwelling (Westella [21]) is within the calculated minimum distance and would therefore be expected to receive noise levels above the ICNG 'Noise affected' noise management level (Appendix E).

### **4.5.3 Mitigation Measures, Management and Monitoring**

#### **Noise Management Plan**

Evolution would continue to implement the noise management measures and monitoring programme detailed in the NMP.

The NMP would be reviewed and revised to incorporate the Modification. This would include additional provisions for providing mitigation to privately-owned receivers with predicted noise levels 3 to 5 dBA above the PSNLs, if requested, in accordance with the NSW Voluntary Land Acquisition and Mitigation Policy (Table 4-15).

Reasonable and feasible acoustic mitigation measures (including provision of mechanical ventilation/comfort systems [e.g. air conditioning] to enable windows to be closed without compromising internal air quality/amenity) would be considered at Lakeview III (22c).

**Table 4-15**  
**Consideration of Reasonable and Feasible Mitigation Options against the NSW Voluntary Land Acquisition and Mitigation Policy**

NSW Voluntary Land Acquisition and Mitigation Policy Approach to Decision Making	Response
<p>1. <i>The applicant must clearly demonstrate that all viable project alternatives have been considered, and all reasonable and feasible avoidance and mitigation measures have been incorporated into the project design to minimise environmental and social impacts and comply with the relevant assessment criteria. Adequate consultation must have occurred with potentially affected community members to identify and respond to potential social and environmental impacts during the preparation of the environmental impact statement.</i></p>	<ul style="list-style-type: none"> <li>• Exceedances are predicted to occur infrequently and under noise enhancing meteorological conditions: <ul style="list-style-type: none"> <li>– Daytime noise levels under calm meteorological conditions comply with the relevant PSNLs.</li> <li>– Occasional moderate inversions in daytime ‘shoulder’ periods would result in some exceedances of the PSNLs.</li> <li>– Night-time noise under strong inversion conditions is the worst-case noise scenario from a noise modelling perspective.</li> </ul> </li> <li>• The infrequency of predicted exceedances is supported by compliance monitoring undertaken for the existing CGO by Evolution and the limited number of complaints (Section 4.5.3).</li> <li>• Acoustic modelling undertaken for the Modification shows that the haul trucks operating on the main haul routes from the open pit up to the active waste rock emplacements/mineralised material stockpiles are the prominent night time noise sources (Appendix E).</li> <li>• The results of previous acoustic modelling have been considered: <ul style="list-style-type: none"> <li>– Operation of the TSF construction fleet during daytime only, was previously shown to appreciably reduce night-time noise levels and has been implemented for the Modification.</li> <li>– Acoustic bunding and/or relocating noise sources on the waste rock emplacements, was previously not found to effectively control noise and therefore was not implemented for the Modification.</li> </ul> </li> </ul>
<p>2. <i>If the applicant cannot comply with the relevant assessment criteria, or the acquisition or mitigation criteria are likely to be exceeded, then the applicant should consider a negotiated agreement with the affected landowner or acquisition of the affected land. If the applicant acquires the land, or enters into a negotiated agreement with the landowner, then that land is not subject to the assessment, mitigation or acquisition criteria set out in this policy, with the exception of the provisions contained under the heading “Use of acquired land”.</i></p>	<ul style="list-style-type: none"> <li>• Development Consent (DA 14/98) provides receivers Westella (21) and Westlea (42) the right to request Evolution to acquire their landholding and the status of these receivers would not change due to the Modification.</li> <li>• No other significant exceedances (&gt;5 dB above the PSNLs) are predicted for the Modification.</li> <li>• Moderate exceedances (3 to 5 dB above the PSNLs) are predicted for the Modification at Lakeview III (22c).</li> <li>• Evolution has consulted with the owner Lakeview III (22c) and has explained the noise modelling results in the context of NSW Government (2014). In particular, Evolution has advised that noise mitigation measures at the receiver are available and these measures would be formalised either via private agreements with Evolution and/or via the CGO’s modified Development Consent (DA 14/98) conditions.</li> </ul>
<p>3. <i>If the applicant has not acquired the land or entered into a negotiated agreement with the landowner, then it is up to the consent authority to weigh up the relevant economic, social and environmental impacts of the development, in accordance with the requirements of section 79C of the Environmental Planning &amp; Assessment Act 1979, and to decide whether the development should be approved or not.</i></p>	<ul style="list-style-type: none"> <li>• The Modification involves continued operations at the existing CGO and is considered justified because the Modification would (Section 6.2): <ul style="list-style-type: none"> <li>– Continue to stimulate economic demand in the local and regional economy.</li> <li>– Provide an additional 10 full time jobs, as well as up to 100 jobs during the short-term construction phase.</li> <li>– Result in net production benefits to Australia (over and above the economic benefits of the approved CGO) of some \$62 Million (M) (present value) and to NSW some \$27 M.</li> </ul> </li> </ul>

Source: After Appendix E; NSW Government (2014).

In accordance with the NSW Voluntary Land Acquisition and Mitigation Policy, the above mitigation measures would also be offered to those privately-owned receivers where voluntary acquisition rights apply (i.e. Westella and Westlea).

#### ***Tailings Lift Construction and Supplementary IWL Development Works***

To minimise potential noise impacts from the CGO during the evening and night-time, tailings lift construction and supplementary IWL development works (e.g. soil stripping activities) would be limited to daytime hours only (i.e. 7.00 am to 6.00 pm) (Section 3.13).

#### ***Noise Agreements***

As noted above, Evolution has entered into noise mitigation agreements with the landowners of two private receivers (Laurel Park and Gumbelah). Noise mitigation/management agreements have also been discussed with other privately-owned receivers in accordance with the NSW Voluntary Land Acquisition and Mitigation Policy.

Evolution would continue to offer noise mitigation agreements to all privately-owned receivers predicted to be within the Noise Management and Noise Affection Zones.

#### ***Construction Noise***

Evolution would consult with those receivers predicted to experience short term construction noise impacts (Goodwood and Westella). Excessive noise impacts would be minimised by managing construction activities to avoid unnecessary noise (e.g. by switching off equipment not in use) (Appendix E).

## **4.6 AIR QUALITY**

An Air Quality and Greenhouse Gas Assessment for the Modification was undertaken by Pacific Environment Limited (PEL) (2018) and is presented as Appendix F.

A description of the existing air quality environment of the CGO is provided in Section 4.6.1. Section 4.6.2 describes the potential impacts of the Modification. Section 4.6.3 outlines proposed mitigation, management and monitoring.

### **4.6.1 Existing Environment**

#### ***Previous Assessment***

An assessment of potential impacts associated with the currently approved CGO was conducted by PEL (2016) for the Mine Life Modification.

The assessment predicted that no exceedances of relevant air quality criteria would occur at any privately-owned receivers due to the approved CGO, inclusive of the cumulative impact from background (i.e. non-mining) sources.

#### ***Air Quality Management and Monitoring***

Air quality management and monitoring at the CGO is conducted in accordance with the currently approved AQMP. An example of existing air quality management at the CGO, the cover over the coarse ore stockpile, is provided in Plate 4-1.



**Plate 4-1: Cover Over the Coarse Ore Stockpile**

The existing CGO air quality monitoring network currently consists of one high volume air sampler, located near the Coniston residence, measuring total suspended particulate (TSP) concentrations. In addition, there are 12 dust deposition gauges in use at the approved CGO. The locations of existing and historic air quality monitoring sites are shown on Figure 2-3.

An analysis of the monitoring data by PEL (2018) indicates the CGO has been operating in compliance with relevant TSP and dust deposition criteria listed in Condition 6.1(a), Schedule 2 of the CGO Development Consent (DA 14/98).

While some dust deposition gauges recorded annual average dust deposition levels above the relevant criteria, these elevated dust deposition levels are generally considered by PEL (2018) to be attributable to local sources and not the CGO.

## Complaints

No complaints relating to air quality have been received from the date of submission of the CGO Mine Life Modification in November 2016 to January 2018 (Appendix F).

### 4.6.2 Potential Impacts

#### Modelling Methodology

PEL (2018) undertook dispersion modelling of the Modification using the CALPUFF modelling package.

Air quality modelling has been conducted to assess potential impacts for two operational scenarios, representative of Year 16 (2020) and Year 20 (2024) of the Modification.

Year 16 (2020) was selected as it is the operational year with the highest combined material movement (i.e. ore and waste rock) and the most activity relating to the development of the IWL. Year 20 (2024) was selected as it is the last year both waste rock and ore will be mined.

Emissions associated with the Modification for Year 16 (2020) and Year 20 (2024) were estimated using contemporary particulate matter emission estimating methodologies (Appendix F).

The dispersion modelling was based on 12 months of meteorological data from 2015, which was selected as a representative year for modelling based on analysis of meteorological data collected between January 2011 and December 2016 (Appendix F).

#### Predicted Impacts

Concentrations of TSP, particulate matter with an aerodynamic diameter less than 10 microns (PM<sub>10</sub>), and particulate matter with an aerodynamic diameter less than 2.5 microns (PM<sub>2.5</sub>) and dust deposition levels associated with the Modification were predicted at privately-owned receivers.

No exceedances of the relevant criteria for 24 hour average PM<sub>10</sub> and PM<sub>2.5</sub>, or annual average TSP, PM<sub>10</sub>, PM<sub>2.5</sub> or dust deposition were predicted at any privately-owned receiver due to the Modification only or cumulatively with other non-mining sources (Appendix F).

Contours showing predicted 24 hour PM<sub>10</sub> concentrations for the Modification scenarios Year 16 (2020) and Year 20 (2024) are provided on Figures 4-9a and 4-9b, respectively.

### 4.6.3 Mitigation Measures, Management and Monitoring

The existing mitigation, management and monitoring measures described in the AQMP would continue to be implemented for the Modification. In order to mitigate air quality emissions during haulage of waste rock to the IWL, additional haul road watering would be undertaken on key haul roads during IWL construction.

The AQMP would be revised as necessary for the Modification, including providing details of the additional watering to be implemented during construction of the IWL and measures to minimise emissions from the realignment of Lake Cowal Road and the pipeline duplication.

Revision of the AQMP may include review and rationalisation of the number of dust deposition gauges in consultation with the EPA and DP&E.

## 4.7 LAND RESOURCES

A description of the existing land resource environment of the CGO is provided in Section 4.7.1. Section 4.7.2 describes the potential impacts of the Modification. Section 4.7.3 outlines the mitigation and management measures relevant to land resources proposed for the Modification.

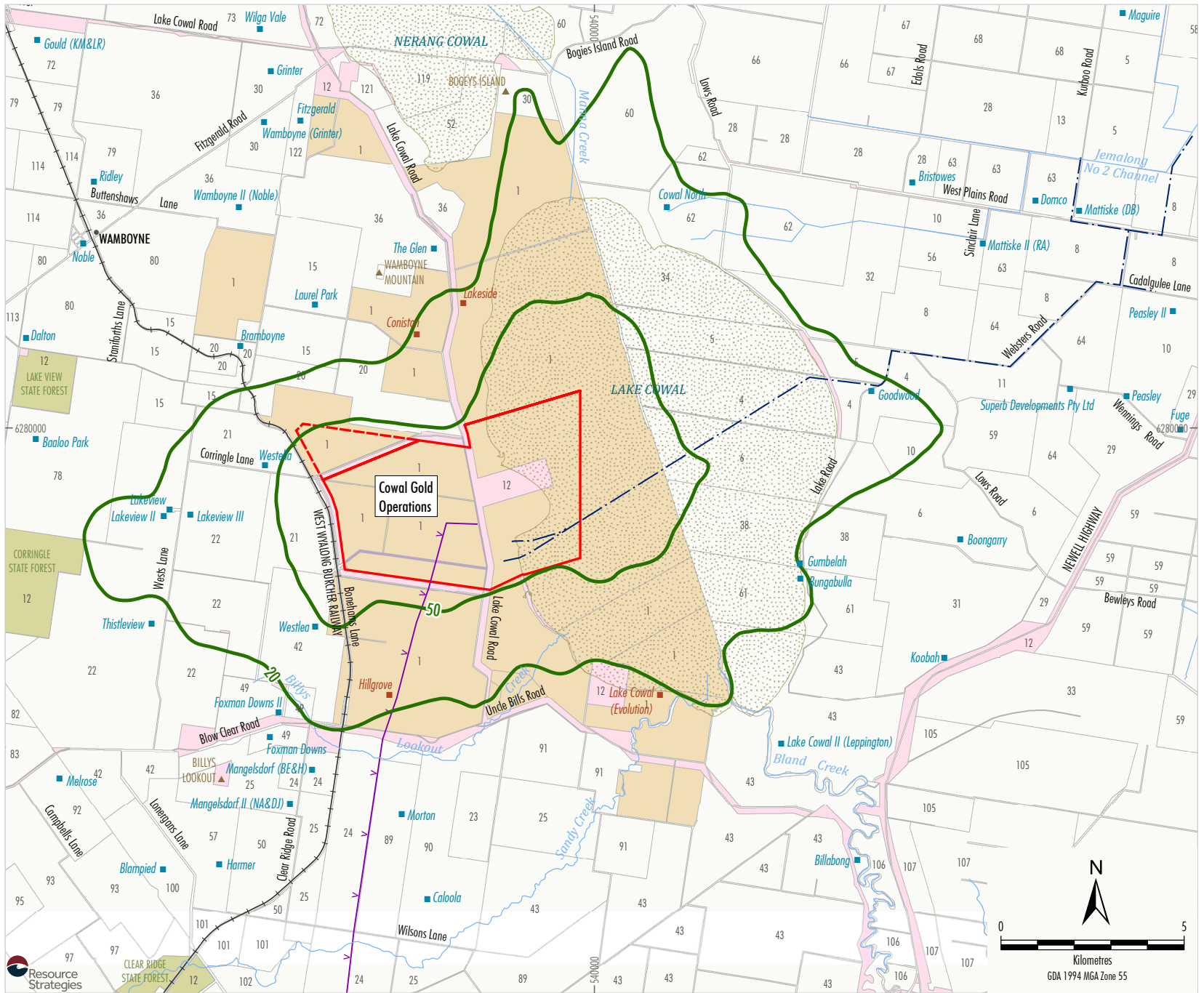
### 4.7.1 Existing Environment

#### Landforms and Topography

The land surrounding the existing CGO is characterised by flat to gently undulating topography, with scattered remnant vegetation. The CGO is located on the central western plains of NSW towards the western edge of the exposed rocks of the Lachlan Fold Belt geological formation and is on the western edge of the ephemeral Lake Cowal.

The landforms are mainly ephemeral lacustrine (i.e. Lake Cowal), extensive gilgai areas, stagnant alluvial plains with ephemeral drainage lines and low hills (e.g. Cowal West Hill).

Local elevations of the landforms surrounding the CGO range from approximately 201.5 m AHD in Lake Cowal (bed level), to approximately 368 m AHD at Billys Lookout (approximately 7 km south-west of ML 1535 and the proposed MLA 1) and Wamboyne Mountain rising to 412 m AHD (approximately 5 km north of ML 1535 and the proposed MLA 1).



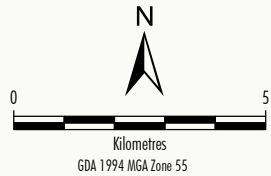
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  - State Forest
  - Company-owned Dwelling
  - Privately-owned Dwelling
  - Railway
  - Electricity Transmission Line
  - Pipeline
  - Project-only 24-hour PM<sub>10</sub> Air Quality Contour (μg/m<sup>3</sup>)

Refer to Figure 1-3b for Landholder Key

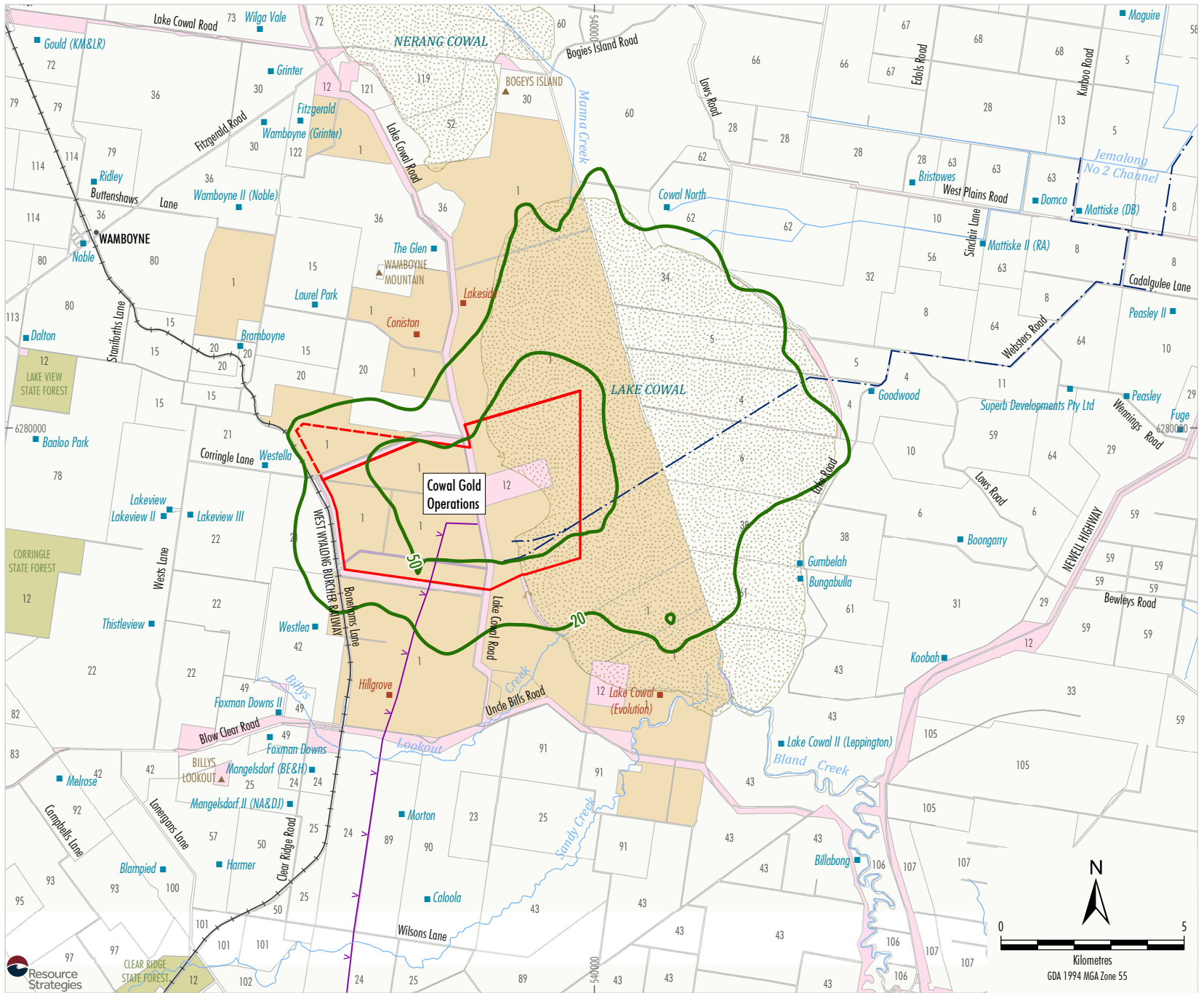
Source: Pacific Environment Limited (2018); Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**Project 24-hour Average PM<sub>10</sub> Concentration (2020) - Modification Only**



**Figure 4-9a**



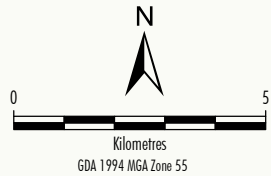
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  - Project-only 24-hour PM<sub>10</sub> Air Quality Contour (µg/m<sup>3</sup>)

Refer to Figure 1-3b for Landholder Key

Source: Pacific Environment Limited (2018); Evolution (2018); © NSW Department of Finance, Services and Innovation (2017)



**CGO PROCESSING RATE MODIFICATION**  
**Project 24-hour Average PM<sub>10</sub> Concentration (2024) - Modification Only**



**Figure 4-9b**

A north-south oriented ridgeline system runs approximately 3.5 km west of Wamboyne Mountain and approximately parallel to the edge of Lake Cowal 8 km to the west. The ridgeline reaches a maximum elevation of 368 m AHD at Billys Lookout. The gentle eastern slopes of this ridgeline drain east into Lake Cowal.

#### *Lake Cowal*

The Lake Cowal/Wilbertroy Wetlands (NSW 040) is listed on the *Directory of Important Wetlands* (DEE, 2018a). Further detail regarding Lake Cowal wetlands is provided in Appendix C.

#### *Existing CGO*

The natural surface level within ML 1535 is approximately 210 m AHD, and landforms of the approved CGO would range from approximately 308 m AHD (northern waste rock emplacement) to approximately -331 m AHD (open pit).

#### *Proposed MLA 1 Area*

The natural surface level of the proposed MLA 1 area ranges from approximately 220 m AHD to 250 m AHD.

### **Strategic Agricultural Land Assessment**

*The State Environmental Planning Policy (Mining, Petroleum and Extractive Industries) 2007* (Mining SEPP) includes mapping of lands identified as Biophysical Strategic Agricultural Land (BSAL). There is no regionally mapped BSAL within or in proximity to the Modification area (Appendix G).

Evolution lodged an application for a Site Verification Certificate (SVC) for the western portion of the proposed MLA 1 (located wholly within EL 7750) on 1 March 2017. On 21 March 2017 a SVC was issued by the Secretary of the DP&E verifying that no BSAL is present in that area.

A supplementary SVC for the eastern portion of the proposed MLA 1 area (located wholly within EL 7750 and adjacent to lands subject to the previous SVC) was lodged on 13 October 2017. The supplementary SVC area is located within DI-Water's regional mapping of highly productive groundwater.

Soil Management Designs (2017) undertook a soil survey of the supplementary SVC area which involved 15 detailed soil pit profiles.

Soil Management Designs (2017) concluded the supplementary SVC area is non-BSAL. This finding agrees with the NSW Government's regional BSAL mapping. On 6 November 2017 a SVC was issued for the supplementary SVC area by the Secretary of the DP&E verifying that no BSAL is present in that area.

Similarly, adjoining Evolution-owned lands and the proposed Modification biodiversity offset areas also do not comprise BSAL, based on the available regional mapping information.

### **Soil Characteristics**

An Agricultural Suitability/Rural Land Capability and Soil Resources Assessment was prepared for the EIS (North Limited, 1998). The dominant soils of the area within ML 1535 are red earths and red podzolic soils (North Limited, 1998).

The soil survey undertaken by Soil Management Designs (2017) determined the soil landscapes within the supplementary SVC area are Sodosol Zone and Gilgai Complex. The dominant soil types of Sodosol Zone and Gilgai Complex are red sodosol and kandosols, respectively.

The remainder of the MLA 1 area consists of Wah Way, Marsden and Euglo soil landscapes (King, 1998).

Sampling works and characterisation of the stockpiled soil resources at the CGO has been undertaken to determine the availability of suitable material for future rehabilitation activities (McKenzie Soil Management, 2013). Results of the characterisation works and options for onsite amelioration of stockpiled soil resources at the CGO are described in Section 5.2.1.

### **Land Use**

The land use within ML 1535 is mining activities. Lands surrounding ML 1535, including MLA 1, are predominantly used for agriculture (e.g. livestock grazing and grain cropping) with some areas forming the biodiversity offsets and remnant vegetation enhancement areas for the existing CGO.

The existing water supply pipeline is buried beneath the bed of Lake Cowal. After burial of the pipeline, portions of the pipeline area were returned to their previous use of fishing when inundated and cropping and/or managed livestock grazing when dry.

### **Final Land Use**

In accordance with Development Consent (DA 14/98) Condition 3.8, a long-term land use strategy has been developed for the CGO (Section 5.3.1).

At lease relinquishment, it is proposed that land use within the former Mining Lease areas would include fenced rehabilitation areas with grazing excluded and areas suitable for agricultural production, including fishing of lake areas or managed grazing by livestock consistent with existing and historical land uses of Lake Cowal (Section 5.3.1).

Evolution-owned land outside the former Mining Lease areas (with the exception of Biodiversity Offset Areas) would continue to be used for farming/agricultural production (Section 5.3.1).

Long-term land uses would be confirmed in consultation with relevant regulatory authorities and key stakeholders (including surrounding landholders) closer to lease relinquishment (Section 5.3.1).

### **Contaminated Land**

A Land Contamination Assessment considering the proposed MLA 1 area was undertaken by Ground Doctor Pty Ltd (2018) in the form of a Stage 1 (Preliminary Investigation) Land Contamination Assessment and is presented in Appendix G.

Following a qualitative desktop study, Ground Doctor Pty Ltd (2018) identified potential areas of environmental concern within the proposed MLA 1 area, including potentially asbestos containing fibro material at a former dwelling and cropping areas, grain storages, a machinery shed and a blacksmiths forge associated with former land uses (Appendix G). None of the identified areas of potential environmental concern are located within the proposed disturbance area for the Modification.

As part of the Land Contamination Assessment, a site inspection and soil sampling and analysis program was undertaken. Results from the soil sampling and analysis program indicated there have been no significant impacts to soil within the MLA 1 area (Appendix G).

A sample of potentially asbestos containing fibro material was also collected during the site inspection and analysis confirmed the material contained asbestos. The presence of asbestos containing material does not affect the suitability of the proposed MLA 1 area for disturbance associated with the Modification, due to the distance of the dwelling area from the proposed Modification disturbance areas (Appendix G).

On the basis of the Stage 1 (Preliminary Investigation) Land Contamination Assessment, the proposed MLA 1 area in its current state is suitable for the land use proposed by the Modification (Appendix G).

## **4.7.2 Potential Impacts**

### **Landforms and Topography**

To allow for the proposed increase in processing throughput rate, the Modification would result in changes to the existing topography within ML 1535 due to the IWL.

To avoid and minimise potential environmental impacts, the IWL has been designed to minimise additional surface disturbance. As such, the surface disturbance footprints of the existing TSFs would be modified to accommodate waste rock and tailings produced during the life of the CGO incorporating the Modification.

Prior to commissioning of the IWL for tailings storage, the existing TSFs (Section 2.6) would continue to be used to store the additional tailings produced. These facilities would be raised to STSF Stage 7 (248.4 m AHD) and NTSF Stage 6 (240.5 m AHD).

The final elevation of the IWL would be approximately 245 m AHD, which is lower than the existing approved final elevation of the TSFs. The final elevations of the waste rock emplacements and the open pit would remain unchanged for the Modification (Figure 3-4).

The final elevations of the landforms for the CGO incorporating the Modification would continue to be lower than the elevations of the landforms surrounding the CGO, including Wamboyne Mountain rising to 412 m AHD and the north-south oriented ridgeline system to the west of the CGO, which reaches a maximum elevation of 368 m AHD at Billy's Lookout.



The IWL would be progressively rehabilitated during the life of the CGO incorporating the Modification. The final landforms of the CGO incorporating the Modification would be revegetated with endemic and/or native vegetation communities, selected specifically for their suitability to the created elevation, substrate conditions and the overriding objective of re-establishing a greater extent of native and/or endemic vegetation within ML 1535 and MLA 1 (Section 5.5.3).

Consistent with the approved CGO, the open pit would remain as a final void, and is predicted to act as a permanent groundwater sink (Section 4.2.1).

Further justification for the design of the final landforms for the CGO incorporating the Modification is provided in Section 6.2.

Potential visual impacts associated with the Modification are described in Section 4.8.

### **Agriculture**

The following components of the Modification have the potential to result in additional impacts to agricultural land (i.e. in addition to the approved CGO):

- the proposed biodiversity offsets for the Modification;
- the proposed MLA 1 area; and
- the proposed duplication of the existing water supply pipeline.

As no agricultural activities are conducted within ML 1535, additional disturbance within ML 1535 associated with the Modification would not impact agricultural production.

### *Proposed MLA 1 Area*

The majority of the proposed MLA 1 area is located on Evolution-owned land adjacent to ML 1535. A portion of the proposed MLA 1 area is periodically used for grazing (Section 4.7.1). Therefore the Modification would result in a change of land use for the proposed MLA 1 area from agricultural to mining.

### *Proposed Biodiversity Offset*

The Modification proposes to establish biodiversity offsets for the additional disturbance areas within ML 1535 and the proposed MLA 1 (Section 4.3.4). The four additional proposed areas for the biodiversity offsets cover approximately 486.5 ha.

The proposed Biodiversity Offset Areas are located on Evolution-owned land, and form part of an area that is periodically used for grazing (Appendix C).

As such, to meet biodiversity offsetting requirements, the Modification would result in a change in land use for this land from agricultural use to conservation. However, given the proposed Biodiversity Offset Areas are only periodically used for grazing, and form only a small part of a larger area of Evolution-owned land available for grazing, no material impacts to the agricultural production of the area are expected.

Notwithstanding, potential economic impacts associated with the loss of this agricultural land have been considered in the Socio-Economic Assessment (Appendix H).

Justification for the biodiversity offset is provided in Section 4.3.4 and Appendix C.

### *Water Supply Pipeline Duplication*

Currently, portions of the existing water supply pipeline corridor are used for fishing when inundated and cropping and/or managed livestock grazing when dry (Section 4.7.1).

The water supply pipeline duplication would result in the disturbance of the corridor for construction works associated with the pipeline construction. Following completion of construction, the land use prior to disturbance will resume (fishing within the lake bounds when inundated and/or cropping and grazing activities when dry).

### **Final Land Use**

The Modification would not change the currently proposed final land use within ML 1535, which includes returning the majority of land within ML 1535 (e.g. rehabilitated waste rock emplacements and TSFs [to become the IWL]) to areas excluded from grazing and agricultural activities. Some areas surrounding the rehabilitated waste rock emplacements, the IWL and the open pit, would be returned to land suitable for grazing (Section 5.3.2). The proposed final land use of land within MLA 1 would be returning to land suitable for agriculture (following final rehabilitation).

The final land use of the water supply pipeline corridor within Lake Cowal, incorporating the pipeline duplication, would not change as a result of the Modification.

## Land Contamination Potential

Contaminated materials identified in the Land Contamination Assessment do not have the potential to be disturbed by construction activities for the Modification and therefore do not require implementation of management measures to minimise the potential for impacts to human health and the environment (Appendix G).

### 4.7.3 Mitigation Measures and Management

The Rehabilitation and Landscape Management Strategy for the Modification is described in Section 5, which describes the integration of the final landforms of the CGO incorporating the Modification with the surrounding landscape via progressive rehabilitation. The existing RMP would be revised to incorporate the rehabilitation concepts for the Modification (Section 5.4).

The soil management measures described in the existing SSMP would continue to be implemented for the Modification. Details of soil stripping procedures and soil re-handling activities are detailed in Section 5.5.2 and would continue to be provided in the MOP. In addition, erosion and sediment control systems detailed in the ESCMP would also continue to be implemented for the Modification.

Mine closure concepts and management measures would continue to be developed via the Mining, Rehabilitation and Environmental Management Process (MREMP) in consultation with the DRG and other relevant regulatory agencies.

## 4.8 VISUAL CHARACTER

The following sub-sections present an assessment of potential visual impacts associated with the Modification.

A description of the existing environment relating to the visual locations and setting is provided in Section 4.8.1. Section 4.8.2 describes the potential impacts of the Modification and Section 4.8.3 outlines mitigation measures and management.

The Visual Management System methodology employed for this assessment has been developed by the United States Department of Agriculture-Forestry Service (1974) and the techniques employed by EDAW Australia (2006). This is an accepted methodology for assessing potential visual impacts in NSW, having been used as part of environmental assessments for other contemporary major projects (including mines) in NSW.

Potential visual impacts were assessed by evaluating the level of visual modification associated with the Modification, in the context of the visual sensitivity of surrounding land use areas (i.e. areas where the CGO incorporating the Modification may be visible).

### 4.8.1 Existing Environment

#### *Visual Settings Surrounding the CGO*

The area surrounding ML 1535 is comprised of a number of distinct land use types and landscape units of varying levels of scenic quality, including agricultural areas, Lake Cowal, residential dwellings, a game reserve, Billy's Lookout and the associated ridgeline system, and Wamboyne Mountain.

Visual settings within the region surrounding the existing CGO are described below for the following settings (i.e. based on distance from the existing CGO):

- Regional setting – greater than 5 km from ML 1535.
- Sub-regional setting – 1 to 5 km from ML 1535.
- Local setting – up to 1 km from ML 1535.

#### *Regional Setting (>5 km)*

The regional setting has attributes of moderate to high scenic quality due to the presence of a wooded north-south oriented ridgeline system running approximately 5 km west of the existing CGO. The contrast between the vegetation and topography of the ridgelines and adjacent agricultural areas adds to the visual interest. The north-south orientated ridgeline system to the rest of the CGO reaches a maximum elevation of 368 m AHD at Billys Lookout (located approximately 7 km south-west of ML 1535).

The other major topographic feature in the regional setting is Wamboyne Mountain, located approximately 5 km north of ML 1535 (412 m AHD).

The regional setting also has attributes of low scenic quality due to the generally flat, cleared dry land agricultural areas that dominate the landscape.

#### *Sub-Regional Setting (1 to 5 km)*

Most of the sub-regional setting has been cleared for grazing and/or cultivation (including land within Lake Cowal itself), and therefore, the sub-regional setting has low to moderate scenic quality.

Remnant tree and shrub vegetation occur primarily on rocky elevated ground, areas of impeded drainage, patches of sandy soils, the shoreline of Lake Cowal and road verges.

The sub-regional setting includes portions Lake Cowal, which is currently inundated. Lake Cowal is listed on the *Directory of Important Wetlands* (DEE, 2018a), however, no aspects relating to visual amenity are described.

#### *Local Setting (<1 km)*

The local setting has already been modified by historic agricultural clearing, and due to the disturbed nature the local setting is considered to be of low scenic quality.

Features of the local setting include a small tree-covered hill of low relief (approximately 260 m AHD) located immediately to the south of ML 1535 [Fellman's Hill].

Other features of the local setting include the local road network (including Lake Cowal Road), the existing ETL to the CGO and the Burcher-West Wyalong Railway.

#### ***Sensitive Visual Locations***

The main issues to consider in the assessment of potential visual impacts are the number of sensitive viewing locations and the level to which the proposed works are visible (i.e. if the works are not seen, there is no impact) (EDAW Australia, 2006). Locations with potential views of the landforms of the CGO incorporating the Modification include those that may already have views of the existing CGO.

Views of the existing CGO landforms of the existing CGO may be available from the following locations (Figure 4-3):

- rural residences to the north, east, south and west of ML 1535;
- Lake Cowal Road looking south, north and east towards ML 1535;
- the public laneway (running between Lake Cowal Road and Buttenshaws Lane) looking south towards ML 1535;
- Newell Highway located to the east of ML 1535;
- Billys Lookout looking north-east over ML 1535;
- Wamboyne Mountain looking south over ML 1535;
- Game Reserve, located approximately 3 km south-east of ML 1535; and
- Burcher-West Wyalong Railway looking east towards ML 1535.

The most sensitive visual settings in the vicinity of the CGO are rural residences. The views of the existing CGO (and potential views of the CGO incorporating the Modification) from rural residences would vary according to the intervening topography and vegetation between the residence and the CGO.

Only limited views of the existing CGO are available from the viewpoints along the Newell Highway due to intervening topography and roadside vegetation and therefore, potential visual sensitivity is considered to be low.

While Billy's Lookout, the associated ridgeline system and Wamboyne Mountain overlook the existing CGO, the potential visual sensitivity from these locations are considered to be negligible given the intervening wooded vegetation coverage and the fact these areas are not routinely accessed by or available to the public.

Potential views of the existing CGO from the Game Reserve are restricted by intervening screening vegetation (particularly along the south-western fringe of Lake Cowal). Potential north-westerly views of the CGO landforms would be available due to the flat lake-bed topography, however, these views would be mostly restricted to portions of the waste rock emplacements and relate to a small extent of the overall viewscape.

Given the distance of the Game Reserve from ML 1535 (i.e. 3 km), and given the CGO landforms would comprise a small proportion of the viewscape, any modification to the existing viewscape due to the CGO incorporating the Modification would be low.

The CGO would be visible from the Burcher-West Wyalong Railway given its close proximity to the CGO, however, given the Railway is not currently used, its visual sensitivity is considered to be low.

### **Existing and Approved CGO**

#### *Modification to the Topography within ML 1535*

The existing CGO has modified the topography within ML 1535, and as such, the existing CGO has modified the visual landscape from relevant viewpoints surrounding the CGO. The main modifying elements of the existing CGO include the waste rock emplacements, the TSFs, soil stockpiles, ore stockpiles and water storages.

#### *Previous Assessment*

A visual assessment was conducted for the approved CGO as part of the Extension Modification. The visual assessment considered changes to the visual landscape as a result of the Extension Modification (i.e. in comparison to the existing CGO at the time of assessment). This assessment showed the visual impact of both the NTSF and STSF at their then approved maximum heights (243 m AHD and 248 m respectively).

The results of this visual assessment indicated a moderate to low potential for visual impact at rural residences (with the closest residence to ML 1535 being approximately 2.5 km to the south-west), and a moderate to low potential visual impact from roads directly adjacent to the ML (i.e. approximately 200 m to 300 m to ML 1535).

#### *Existing Mitigation and Management Measures*

In accordance with the LMP, the following measures have been implemented at the existing CGO to maintain and improve visual amenity:

- rehabilitation of existing CGO landforms has commenced and is progressive;
- trees and shrubs have been established in accordance with the requirements of the Bland Shire Council for the maintenance of satisfactory visual amenity from outside ML 1535; and
- the visual appearance of buildings, structures, facilities or works have been designed in consideration of blending with the surrounding landscape.

#### *Night-Lighting*

Night-lighting is emitted from the following three main sources at the existing CGO:

- overhead lighting of the process plant area and administration area;
- mobile lighting plants on top of waste rock emplacements; and
- mobile vehicle mounted lights (e.g. work vehicles in various locations within ML 1535).

Direct views of night-lighting sources, including mobile machinery lights and operational lighting, are available from some exposed positions. Night-lighting impacts on the local and sub-regional settings occur with a glow above operational areas that contrasts with the night sky. This effect decreases with distance, however, the glow is visible at nearby residences and along transport routes.

In the period 2016 to 2018 (i.e. since the Mine Life Modification) no complaints have been received regarding night-lighting.

In accordance with Condition 6.5 of Schedule 2 of the Development Consent (DA 14/98), Evolution is required to take all reasonable and feasible measures, in consideration of Australian *Standard AS 4282-1997 Control of the obtrusive effects of outdoor lighting*, to mitigate visual and off-site lighting impacts of the CGO. Measures currently employed to mitigate potential impacts from night-lighting at the existing CGO include the following:

- scheduling of mining operations, where practicable, so that evening and night-time operations on the northern and southern waste rock emplacements would be located to reduce the potential for direct lighting impacts to locations outside of ML 1535;
- restriction of night-lighting to the minimum required for operations and safety requirements, where appropriate;
- use of unidirectional lighting techniques; and
- use of light shields to limit the spill of lighting.

#### 4.8.2 Potential Impacts

The Modification involves the continued use and expansion of the existing waste rock emplacements with the maximum approved heights of both the northern and southern waste rock emplacements remaining unchanged.

The continued use and modification of the TSFs to form one larger TSF (the IWL) would modify the existing landscape (which includes the existing CGO) from relevant viewpoints surrounding the CGO. Due to the construction of the IWL, the TSFs would not reach their currently approved maximum heights (264 m AHD for the NTSF and 272 m AHD for the STSF respectively). In addition, the Modification would involve the continued use of night-lighting at the CGO.

##### **Visual Impact Assessment Methodology**

The potential visual impacts of the Modification were qualitatively assessed using the techniques developed by EDAW Australia (2006). The potential visual impacts of the Modification were assessed by evaluating the level of visual modification associated with the development of the CGO (incorporating the Modification), in the context of the visual sensitivity of relevant surrounding land use areas from which the CGO (incorporating the Modification) may be visible.

##### *Visual Modification*

The level of visual modification can be measured as the level of visual contrast between the modified and existing visual landscape. Throughout the visual catchment (or zone of visual influence) the level of visual modification generally decreases with distance (i.e. the level of visual modification due to the Modification decreases with distance from the CGO) (EDAW Australia, 2006).

The level of visual modification can be characterised as follows:

- Negligible (or very low) level of visual modification – where the CGO incorporating the Modification is distant and/or relates to a small proportion of the overall viewscape.
- Low level of visual modification – where there is minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the CGO incorporating the Modification and the existing landscape. In this situation the development may be noticeable, but does not markedly contrast with the existing landscape.
- Moderate level of visual modification – where a component of the CGO incorporating the Modification is visible and contrasts with the existing landscape, while at the same time achieving a level of integration. This occurs where surrounding topography, vegetation or existing landscape provide some measure of visual integration or screening.
- High level of visual modification – where the major components of the CGO incorporating the Modification contrast strongly with the existing landscape.

##### *Visual Sensitivity*

Visual (viewer) sensitivity is a measure of how critically a change to the existing landscape is viewed from various areas, and is a function of both land use and duration of exposure (i.e. individuals generally view changes to the visual setting of their dwelling more critically than changes to the visual setting of the broader setting in which they travel or work) (EDAW Australia, 2006).

The existing landscape includes the existing CGO. Construction of the CGO commenced in 2004, with mining operations commencing in 2005, and as such, the existing CGO has formed part of the existing visual landscape for approximately 14 years.

This visual assessment has considered the change to the existing landscape associated with the Modification (e.g. development of the IWL and relocation of infrastructure).

Visual sensitivity depends on a range of viewer characteristics. The primary characteristics used in this visual assessment are land use, the distance to the CGO and its visibility from critical viewpoints. Typical visual sensitivity levels are presented in Table 4-16.

For the purposes of this visual assessment, land use areas in the vicinity of ML 1535 were characterised in terms of low, moderate or high visual sensitivity, as follows:

- Low visual sensitivity – local roads (e.g. Lake Cowal Road).
- Moderate visual sensitivity – rural residences within 2.5 to 5 km of the CGO.
- High visual sensitivity – rural residences less than 2.5 km from the CGO.

**Table 4-16**  
**Typical Visual (Viewer) Sensitivity Levels**

Use Area	Local Setting		Sub-Regional Setting		Regional Setting
	0-0.5 km	0.5-1 km	1-2.5 km	2.5-5 km	>5km
Natural Area – Recreation	H	H	H	M	L
Residential – Rural	H	H	H	M	L
Tourist Roads	H	M	M	L	L
Other Main Roads	M	L	L	L	L
Local Roads	L	L	L	L	L
Industrial Areas	L	L	L	L	L

Source: EDAW Australia (2006).

#### Visual Impact Matrix

The potential visual impact associated with the Modification was assessed for each visual assessment location in accordance with the matrix presented in Table 4-17. The visual impact matrix considers the combination of visual modification and viewer sensitivity.

**Table 4-17**  
**Visual Impact Matrix**

Visual Modification	Viewer Sensitivity			
	H	M	L	VL
H	H	H	M	M
M	H	M	L	L
L	M	L	L	L
VL	L	VL	VL	VL

Source: EDAW Australia (2006).

#### Visual Assessment Locations

Visual assessment locations were chosen based on the most potentially sensitive visual settings/land uses (i.e. rural residences and local roads/laneways) which would be routinely accessed or readily accessible, and are located within the regional (>5 km), sub-regional (1 to 5 km) and local (<1 km) settings.

Billys Lookout, Wamboyne Mountain, the Newell Highway, the Game Reserve and the Burcher-West Wyalong Railway have not been considered further as these viewpoints are considered to be of a lower sensitivity than the visual assessment locations that have been assessed (Section 4.8.1).

The Visual Assessment locations are the Westlea and Lakeview dwellings given their distance and elevation in relation to the CGO. Locations and aspects for the Visual Assessment are shown on Figure 4-3.

#### Visual Simulations

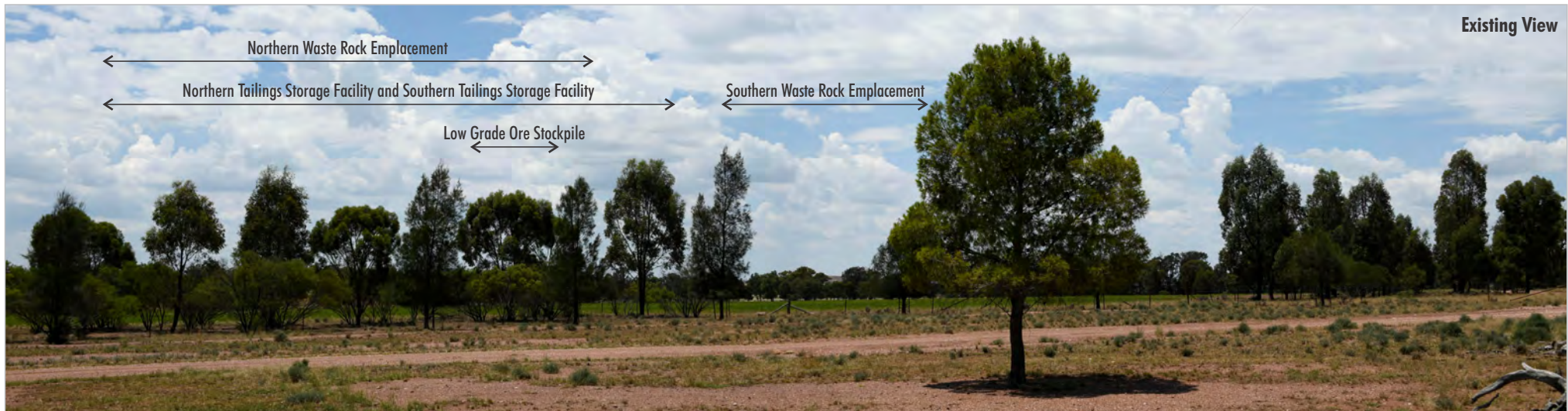
Visual simulations were prepared to provide an indication of the potential visual modification associated with the Modification (i.e. in comparison to the existing CGO) from each visual assessment location (Figures 4-10a to 4-11b).

The visual simulations were prepared for Year 20 (2014) and Year 24 (2018), which are considered to be representative of the maximum level of potential visual modification during the operation of the CGO incorporating the Modification.

In Year 20 (Figure 3-2), construction of the IWL embankment would have commenced and additional soil stockpiles formed to north and south-east of the IWL embankment respectively. The northern waste rock emplacement would have increased in elevation and the southern waste rock emplacement would have reached its final elevation with rehabilitation progressed. Additionally, the low grade ore stockpile would have increased in elevation. Some additional rehabilitation (i.e. in comparison to the exiting CGO) would have occurred on both the northern and southern waste rock emplacements, however, a significant portion of the northern waste rock emplacement would still be active (i.e. rehabilitation would not have commenced in these active areas).

In Year 2024 (Figure 3-3), the IWL embankment would be fully constructed and progressive rehabilitation would have commenced. Additionally, the northern waste rock emplacement would have increased in elevation and the low grade ore stockpile contained within would have reached its final elevation. The southern waste rock emplacement would be fully rehabilitated, and progressive rehabilitation of the northern waste rock emplacement would have occurred.

Post-mining visual simulations were also prepared to show the final rehabilitated landforms of the CGO incorporating the Modification.

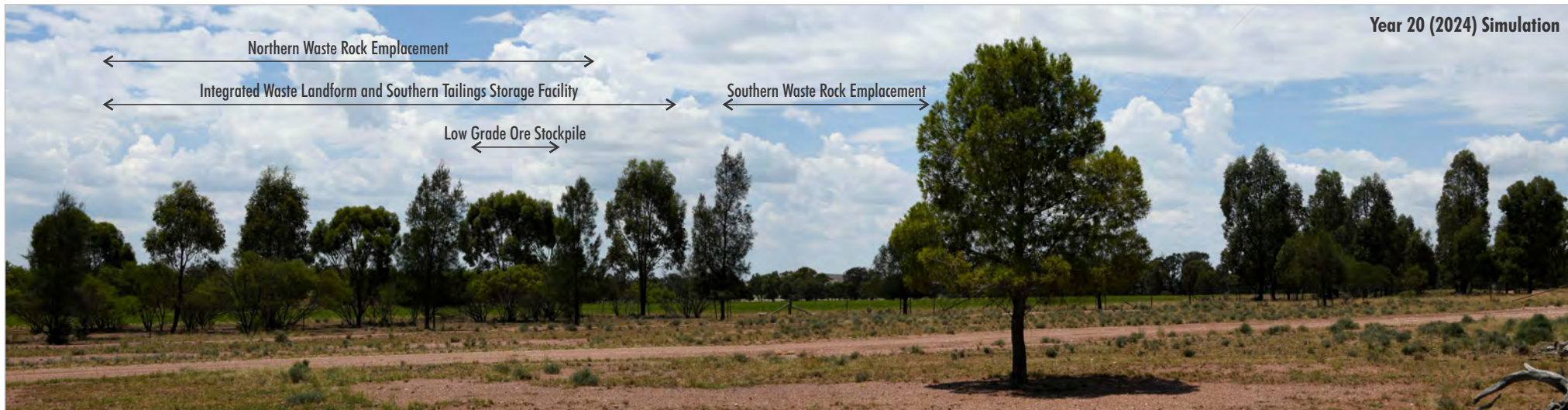


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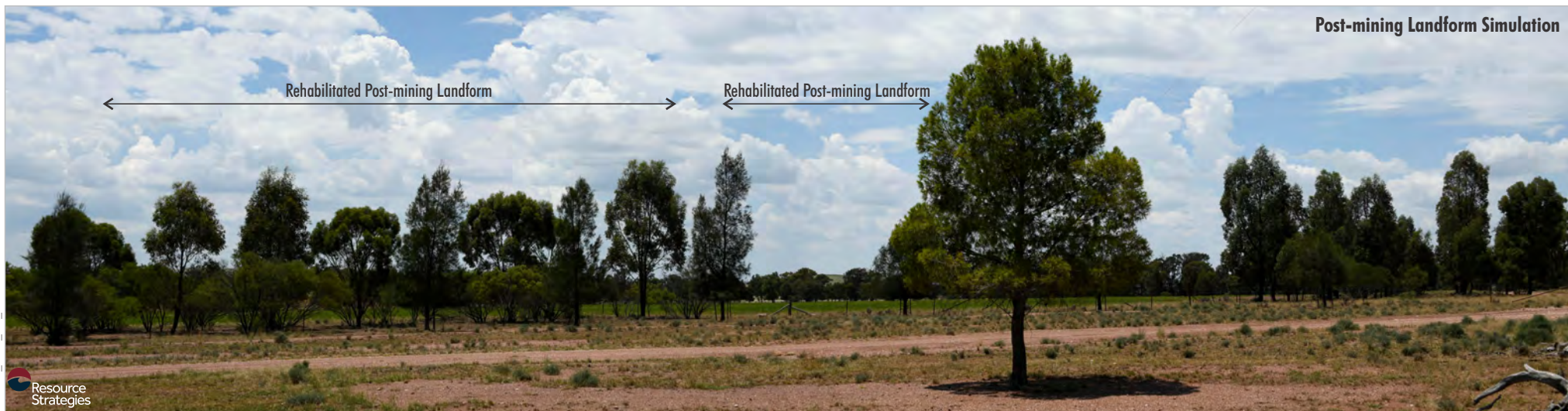


CGO PROCESSING RATE MODIFICATION  
 Existing View and Visual Simulation (2020) -  
 "Westlea" Dwelling

Figure 4-10a



Year 20 (2024) Simulation



Post-mining Landform Simulation

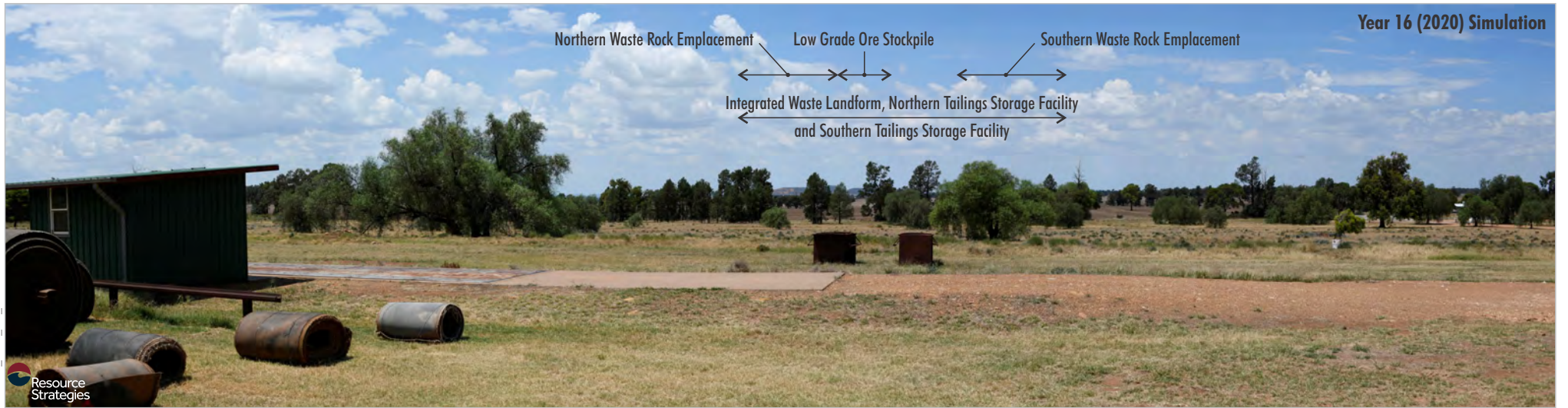
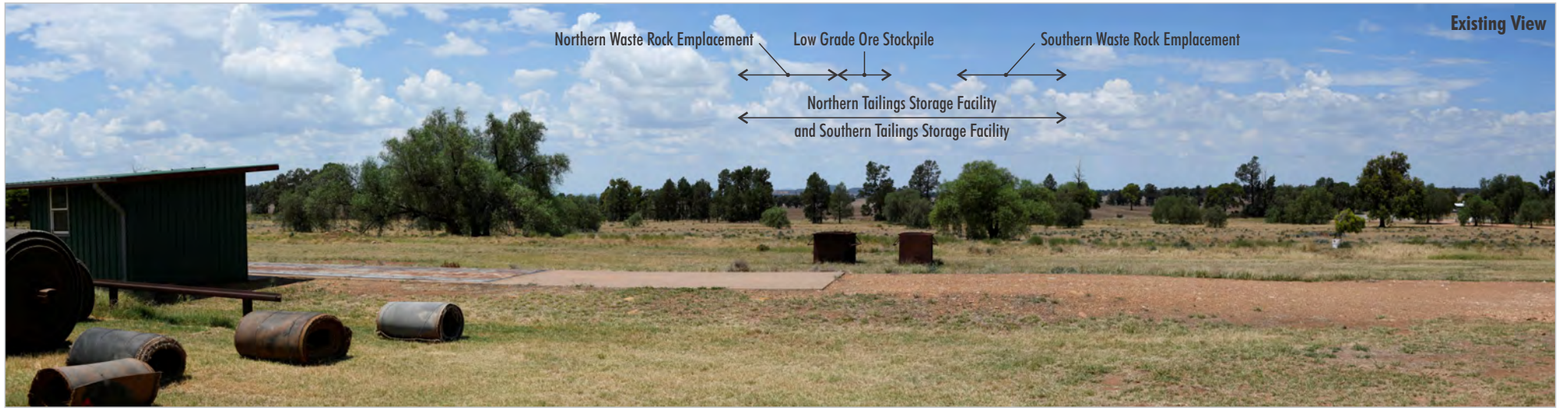
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CGO PROCESSING RATE MODIFICATION  
 Visual Simulations  
 (2024 and Post-mining Landform) -  
 "Westlea" Dwelling

Figure 4-10b



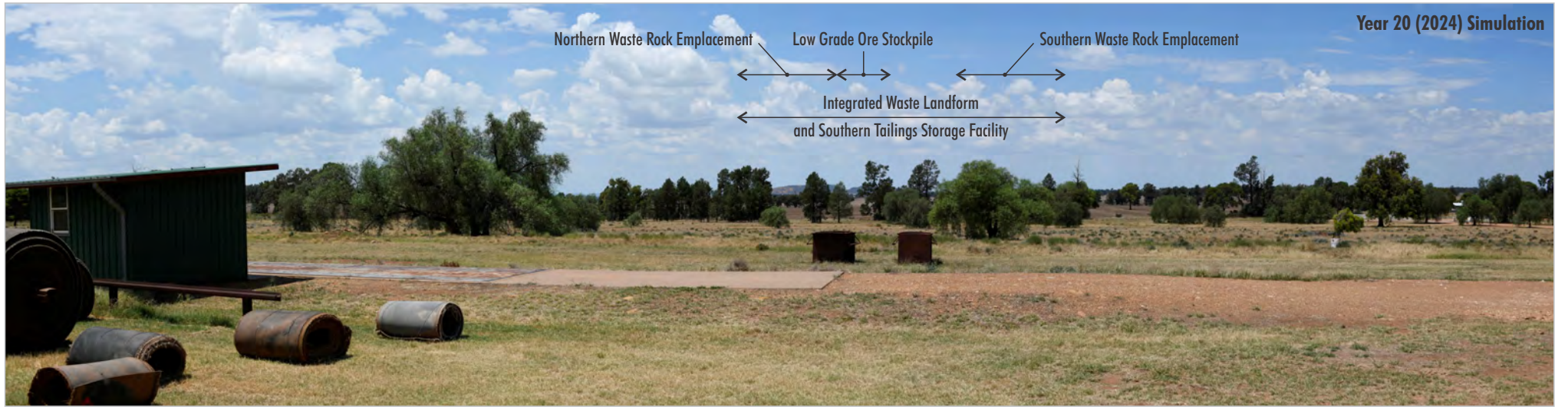


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CGO PROCESSING RATE MODIFICATION  
 Existing View and Visual Simulation (2020) -  
 "Lakeview" Dwelling

**Figure 4-11a**



HAL-16-41\_Mod14\_PPM\_012A



CGO PROCESSING RATE MODIFICATION  
Visual Simulations  
(2024 and Post-mining Landform) -  
"Lakeview" Dwelling

Figure 4-11b

Table 4-18 summarises the results of the visual assessment undertaken for the Approved CGO incorporating the Modification.

### **Regional Setting (>5 km)**

No additional impact from viewpoints categorised within the regional setting is expected due to the Modification. As such, these viewpoints have not been assessed further.

### **Sub-Regional Setting (1 to 5 km)**

#### *Westlea Dwelling*

The Westlea dwelling is the closest residence to ML 1535 (i.e. approximately 2 km south-west) (Figure 4-3). Views of the existing CGO from this residence are mostly obscured by intervening vegetation and undulating topography, and relate to a small proportion of the overall viewscape (Figures 4-10a and 4-10b).

The level of visual impact would be reduced due to the construction of the IWL, as the NTSF is removed (incorporated into the IWL landform) and the IWL would facilitate a reduction in the final height of the STSF.

The greatest visual modification at the Westlea dwelling would occur when the height of the northern waste rock emplacement increases to its final height and prior to rehabilitation.

The potential visual modification of the northern waste rock emplacement would also result from the contrast in colour and texture between the undisturbed natural areas and the newly constructed outer batters (Figures 4-10a and 4-10b). This visual modification would be confined to the upper batters of the northern waste rock emplacement during its progressive increase in height and prior to its rehabilitation.

Given the low level of visual modification coupled with the moderate to high visual sensitivity at the Westlea dwelling, a moderate to low level of visual impact is expected (Table 4-18). The level of visual impact would progressively reduce once vegetation cover begins to establish on the rehabilitated northern waste rock emplacement (Figures 4-10a and 4-10b) and the southern waste rock emplacement is fully rehabilitated.

Additionally, the post-mining simulation (Figure 4-10b) indicates that following progressive and final rehabilitation, the level of visual impact would reduce to low.

#### *Lakeview Dwelling*

The Lakeview dwelling is located approximately 4.5 km west of the western boundary of ML 1535 (Figure 4-3). The existing view shows the CGO in the background, with the southern and northern waste rock emplacements and the low grade ore stockpile visible at a distance and obscured by intervening vegetation and topography (Figures 4-11a and 4-11b).

The level of visual impact would be reduced due to the construction of the IWL, as the NTSF is removed (incorporated into the IWL landform) and the IWL would facilitate a reduction in the final height of the STSF.

The greatest visual modification at the Lakeview dwelling would occur as the height of the northern waste rock emplacement increases. The potential visual modification would also result from the contrasting colour of the CGO landforms (incorporating the Modification) with the surrounding landscape.

Given the moderate level of visual modification and the moderate visual sensitivity at the Lakeview dwelling, a moderate level of visual impact is expected (Table 4-18).

**Table 4-18**  
**Visual Impact Assessment Summary (Approved CGO Incorporating the Modification)**

Setting	Visual Assessment Location	Sensitivity	Visual Modification Level	Impact	Impact After Final Rehabilitation
Sub-Regional Setting (1-5 km from CGO)	Westlea Dwelling	M-H	L	M-L	L
	Lakeview Dwelling	M	M	M	L

The level of visual impact would progressively reduce once vegetation cover begins to establish on the rehabilitated waste rock emplacements (Figure 4-11a and Figure 4-11b) and the low grade ore stockpile decreases in elevation and final rehabilitation, and reduction in the height of the low grade ore stockpiles as this ore is processed, the level of visual impact would reduce to low.

Additionally, the post-mining simulation (Figure 4-11b) indicates that following progressive and final rehabilitation, and reduction in the height of the low grade ore stockpiles as other ore is processed, the level of visual impact would reduce to low.

#### **Local Setting (<1 km)**

No additional impact from viewpoints categorised within the local setting is expected due to the Modification. As such, these viewpoints have not been assessed further.

#### **Night-Lighting**

The Modification would have the potential to result in additional night-lighting sources due to the construction of the IWL, which would include haulage of waste rock 24 hours per day.

The intensity of night-lighting for the Modification would generally be similar to the existing CGO, and the existing mitigation measures relevant to night-lighting implemented at the CGO (e.g. unidirectional lighting and light shields) (Section 4.8.1) would continue for the Modification. Therefore, it is expected that potential night-lighting impacts would be similar to those associated with the approved CGO.

#### **4.8.3 Mitigation Measures and Management**

Existing mitigation and management measures to maintain visual amenity in the area surrounding the CGO would continue to be implemented for the Modification.

#### **Land Management Plan**

Mitigation and management measures are described in the LMP and would continue to be implemented for the Modification.

#### **Progressive Rehabilitation**

Progressive rehabilitation would continue for the Modification, reducing the contrast between the CGO landforms incorporating the Modification and the surrounding landscape.

Rehabilitation media would continue to include native and/or endemic grass, shrub and/or tree species consistent with those found in other elevated landforms in the region (Section 5).

#### **Night-Lighting**

In accordance with CGO Development Consent (DA 14/98) conditions, Evolution would continue to take all reasonable and feasible measures, including those described in Section 4.8.1, to mitigate potential impacts from night-light from the CGO incorporating the Modification.

### **4.9 ROAD TRANSPORT**

A Road Transport Assessment for the Modification has been undertaken by GTA Consultants (2018) and is presented in Appendix H. Appendix H provides an assessment of the existing traffic conditions in the immediate CGO surrounds and the estimated increase in traffic generated as a result of the Modification.

A description of the existing road transport environment of the CGO is provided in Section 4.9.1. Section 4.9.2 describes the potential impacts of the Modification. Section 4.9.3 outlines the mitigation and management measures relevant to road transport proposed for the Modification.

A general description of the existing access routes to the CGO is provided below.

#### **West Wyalong Access Route**

This existing access route to the approved CGO from West Wyalong follows Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane to the existing CGO entrance.

#### **Forbes Access Route**

Access from Forbes to the CGO is via the Newell Highway, West Plains Road, Bogies Island Road, Lake Cowal Road (east-west), Fitzgerald Road and Lake Cowal Road (north-south) to the existing CGO entrance (preferred route).

When the water level is high in Lake Cowal/Nerang Cowal, the Forbes access route via Lake Cowal Road and Bogies Island Road is closed. Under these circumstances, mine traffic from Forbes uses Newell Highway, Lachlan Valley Way, Driftway Road, Warroo Road, Corinella Road, Marsden Road, Lake Cowal Road (east-west), Fitzgerald Road, Lake Cowal Road (north-south) (alternative high water route 1).

On occasions, unsealed roads in the region are closed due to weather conditions. When this occurs, neither the preferred route nor the alternative high water route are available, and mine traffic from Forbes travels via West Wyalong, on a route made up of sealed roads only, via Newell Highway, then the West Wyalong Access Route (Appendix H).

#### **Condobolin Access Route**

Access from Condobolin is via The Gipps Way, Burcher Road, Bena Street, Lake Cowal Road (east-west), Fitzgerald Road and Lake Cowal Road (north-south) to the existing CGO entrance.

On occasions, unsealed roads in the region are closed due to weather conditions, so parts of the preferred mine access route from Condobolin are not available. Under these circumstances, CGO traffic from Condobolin uses an alternative route, made up of sealed roads only, via The Gipps Way, Burcher Road, Bena Street, Wamboyne Road (Fitzgerald Road), Blow Clear Road, Bonehams Lane (Appendix H).

#### **4.9.1 Existing Environment**

The existing road system and traffic flows in the vicinity of the approved CGO are described in detail in Appendix H and are summarised below. The local road networks are shown on Figure 4-12.

##### **Road Hierarchy**

Existing roads proposed for use during the modified CGO are classified as arterial, sub-arterial and local roads in accordance with the NSW Road and Traffic Authority (RTA's) *Guide to Traffic Generating Developments* (RTA, 2002) and Austroad's *Rural Road Design: A Guide to the Geometric Design of Rural Roads* (Austroads, 2003).

##### **Arterial Roads**

In the vicinity of the CGO, the Newell Highway (HW17) is a sealed arterial road which links West Wyalong, Forbes and Parkes. Traffic along this highway includes a range of heavy vehicles such as B-doubles and road trains. The Newell Highway is a State Road and is under the management and control of the RMS (Appendix H).

##### **Sub-Arterial Roads**

Ungarie Road is a sealed sub-arterial road which extends from the Mid-Western Highway (SH6) west of West Wyalong to Ungarie. Ungarie Road carries through traffic from West Wyalong to Condobolin, including a range of heavy vehicles such as B-doubles and road trains.

West Wyalong – Condobolin Road is a sealed sub-arterial road which extends from Ungarie Road in Ungarie to Condobolin. West Wyalong-Condobolin Road also carries through traffic from Ungarie to Condobolin, including a range of heavy vehicles such as B-doubles and road trains.

The Gipps Way is a sealed sub-arterial road which extends from William Street in Condobolin towards West Wyalong. The Gipps Way also carries through traffic from Ungarie to Condobolin, including a range of heavy vehicles such as B-doubles and road trains.

These sub-arterial roads are regional roads are under the care and control of various local councils, with funding assistance provided by the RMS (Appendix H).

##### **Local Roads**

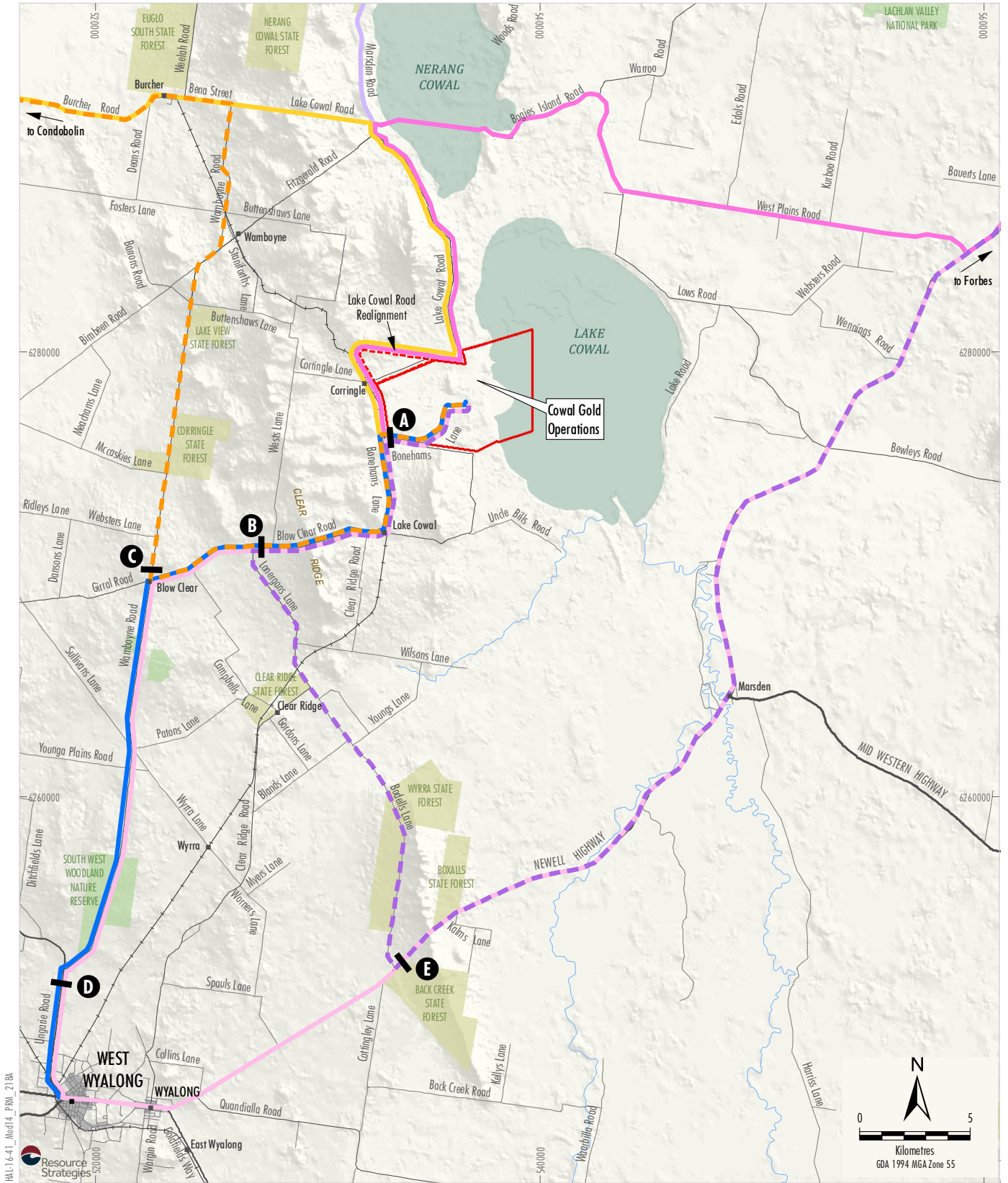
In the vicinity of the CGO local roads provide access for local traffic and landholders to access their properties, with periods of heavy traffic relating to harvesting operations in the relevant seasons associated with grain cropping. Local roads of relevance to the Modification include: West Plains Road, Bena Street, Fitzgerald Road, Wamboyne Road, Wamboyne Dip Road, Blow Clear Road, Bonehams Lane, Lake Cowal Road, Lonergans Lane, Clear Ridge Road, Bodells Lane, Bogies Island Road and Burcher Road.

These local roads are under the care and control of various local councils (predominantly Bland Shire Council) (Appendix H).

##### **Existing Road Conditions**

###### **Approved CGO Access Route**

The approved CGO access route from West Wyalong comprises Ungarie Road, Wamboyne Road, Blow Clear Road and Bonehams Lane. This route was upgraded in 2005 as part of relevant CGO works and is therefore of recent design construction standard and provides a 7 m to 8 m carriageway with 1 m sealed shoulders.



**LEGEND**

- Mining Lease Boundary (ML 1535)
- Mining Lease Application (MLA 1)
- National Park & Nature Reserve
- State Forest
- Railway
- Existing Mine Access Route (West Wyalong)
- Existing Preferred Mine Access Route (Condobolin)
- Existing Preferred Mine Access Route (Forbes)
- Existing Mine Access Route (Forbes - Sealed Network)
- Existing Temporary Mine Access Route (Forbes - High Water Level 1)
- Proposed Mine Access Route (Condobolin - Sealed Network)
- Proposed Temporary Mine Access Route (Forbes - High Water Level 2)
- Traffic Survey Location

Source: GTA Consultants (2018); Geoscience Australia (2006); NSW Department of Planning and Environment (2017); Office of Environment and Heritage NSW (2017)



**CGO PROCESSING RATE MODIFICATION  
Local Road Networks**

**Figure 4-12**

*Newell Highway (HW17)*

The Newell Highway (HW17) is a two lane undivided road with a sealed pavement of generally 7 m to 8 m wide with 1 m to 2 m wide sealed shoulders (Appendix H).

*Ungarie Road*

Ungarie Road is a two lane undivided road with a sealed pavement generally 7 m to 8 m wide with 1 m to 2 m sealed shoulders (Appendix H).

*West Wyalong – Condobolin Road*

West Wyalong – Condobolin Road is a two lane undivided road with a sealed pavement generally 7 m to 8 m wide with 1 to 2 m sealed shoulders (Appendix H).

*The Gipps Way*

The Gipps Way is a two lane undivided road with a sealed pavement generally 7 m to 8 m wide with 1 m to 2 m sealed shoulders (Appendix H).

*Bogies Island Road*

Bogies Island Road follows a series of right and left hand horizontal curves. At its northernmost point where Bogies Island Road meets Lake Cowal Road, a left hand horizontal curve bend combines with a vertical crest curve which provides restricted forward visibility (Appendix H). It is noted that marker posts are provided for night-time delineation of this combination of horizontal and vertical curvature. Bogies Island Road is impassable during wet periods.

At its western end Bogies Island Road connects to Burcher Road at the location of a left-right staggered uncontrolled intersection (Appendix H).

*West Plains Road*

West Plains Road includes a horizontal and vertical alignment on the section between Lows Road and Newell Highway is generally straight and level. At the intersection with Lows Road, West Plains Road turns through a 90-degree bend to the north. At its eastern end, West Plains Road intersects with the Newell Highway at a priority controlled T-intersection, with a widened shoulder for southbound traffic on the Newell Highway.

*Wamboyne Dip Road*

Wamboyne Dip Road is a dirt track of generally 8 m road corridor width which connects to Bogies Island Road in the north and to Wamboyne Road in the south (Appendix H).

*Lake Cowal Road*

An east-west alignment extends eastwards from the outskirts of the village of Burcher across Nerang Cowal to Bogeys Island. A separate section of Lake Cowal Road intersects with Fitzgerald Road approximately 500 m south of the above priority intersection, and extends in a roughly north-south direction along the western side of Lake Cowal and around the western side of the ML 1535 boundary to intersect with Blow Clear Road at its southern end.

The north-south alignment of Lake Cowal Road provides a combination of dirt and gravel track, generally of 8 m road corridor width. It connects to Fitzgerald Road via an uncontrolled T-intersection at its northernmost point and to the mine access road at a priority controlled intersection. The alignment has a number of horizontal curves some of which include the provision of marker posts and advance directional signage.

*Fitzgerald Road*

Fitzgerald Road is some 500 m to the south of Bogies Island Road, providing access to Lake Cowal Road via an uncontrolled intersection. It is a dirt track of generally 8 m road corridor width.

*Wamboyne Road*

Wamboyne Road provides a link between Ungarie Road and Bena Street/Lake Cowal Road east of the village of Burcher. At its southern end, Wamboyne Road intersects with Ungarie Road at a priority controlled T-intersection some 6 km north of the Newell Highway. Wamboyne Road provides access to the village of Wamboyne. Wamboyne Road has a sealed surface typically 6 m wide with narrow shoulders.

There is a short, unsealed length where Wamboyne Road crosses the former West Wyalong Burcher branch railway and intersects with Fosters Lane and Buttenshaws Lane. The alignment of Wamboyne Road at this location reflects the requirements of the former level crossing, with vehicles passing through a right hand bend then left hand bend so that the former railway and road are perpendicular at the level crossing.

**Blow Clear Road**

Blow Clear Road extends westwards from Wamboyne Road. The extension of this route to the east of Wamboyne Road is Girral Road, which links to West Wyalong Condobolin Road at its eastern end. Blow Clear Road has a sealed surface with a similar cross-section to Wamboyne Road and intersects with Lonergans Lane approximately 5 km from Wamboyne Road, and with Bonehams Lane approximately 11 km from Wamboyne Road. Blow Clear Road, Girral Road (unsealed) and Wamboyne Road intersect at a four way intersection, at which Girral Road and Blow Clear Road are the minor roads, and are aligned at approximately 65 to 70 degrees to Wamboyne Road.

**Lonergans Lane**

Lonergans Lane provides a link between Blow Clear Road in the north and the Newell Highway at Back Creek in the south. The intersection of Blow Clear Road with Lonergans Lane is a priority controlled T-intersection.

**Clear Ridge Road**

Clear Ridge Road provides a link between Blow Clear Road in the north and the Newell Highway at Back Creek in the south. Road train access is permitted on Clear Ridge Road between Newell Highway and Blow Clear Road, subject to a maximum 80 kilometres per hour (km/h) speed limit.

**Bodells Lane**

Bodells Lane provides a link between Blow Clear Road in the north and the Newell Highway at Back Creek in the south. The intersection with the Newell Highway is a priority controlled T-intersection, with “give way” signs for Bodells Lane traffic and localised widening of the Newell Highway to two lanes southbound to allow through traffic to pass around a vehicle slowing to turn right into Bodells Lane.

**Bonehams Lane**

Bonehams Lane connects to Blow Clear Road at its southernmost extent via a priority controlled T-intersection just west of the former level crossing with the West Wyalong Burcher railway. Approximately 4.5 km north of Blow Clear Road, the road turns through 90 degrees to continue westward as the mine access road.

**Burcher Road**

Burcher Road forms an east-west link between The Gipps Way in the west and the Newell Highway in the east. At its western end, Burcher Road intersects with The Gipps Way at a priority controlled T-intersection. Burcher Road provides access to the village of Burcher.

Between The Gipps Way and Burcher, Burcher Road is sealed with 6 m pavement width and grass shoulders. The sealed section of Burcher Road provides a satisfactory horizontal and vertical alignment.

**Bena Street**

Bena Street is a continuation of Burcher Road through the village of Burcher. The posted speed limit is 50 km/h, with a 40 km/h school zone.

**Existing Traffic Volumes**

As a component of the Road Transport Assessment, surveys were conducted in 2017 for a period of one week. Results of the traffic surveys have been reviewed, and the average daily traffic volumes are summarised in Table 4-19.

**Table 4-19  
Average Daily Traffic and Volume**

Site	Location	Average Daily Traffic Volume
A	CGO Access Road	344
B	Blow Clear Road	334
C	Wamboyne Road	95
D	Ungarie Road	1,292
E	Newell Highway	2,068

Source: Table 3.3, Appendix H.



## Road Safety

GTA Consultants (2018) reviewed available traffic accident data for the period 2011 to 2017 for the roads relevant to the Modification (Appendix H).

Over the investigation period and routes reviewed, a total of 41 crashes occurred, resulting in four fatalities and 46 people being injured. No reported crashes occurred on the Burcher Road – Bena Street – Lake Cowal Road – Bogies Island Road – West Plains Road route, or on the Bodells Lane – Lonergans Lane route (Appendix H).

### 4.9.2 Potential Impacts

#### Traffic Generation

##### Staff Movements

Construction activity from the Modification would increase the workforce at the CGO by approximately 100 workers in 2019. Their shifts would generally occur between 7.00 am and 6.00 pm, seven days per week, however it is assumed that the construction workforce would travel during the existing CGO peak hours, for the purposes of the assessment (Appendix H). Traffic movements associated with the short term construction phase would be limited by the use of shuttle buses.

Traffic increases would also arise from an additional 10 operation workers travelling to and from the CGO, as a consequence of the Modification. It is likely that this small number of additional workers would be accommodated in the existing buses to and from the CGO which currently operate with spare seating capacity, and so would not generate any additional vehicle trips on the road network (Appendix H).

##### Truck Movements

The construction activities associated with the Modification are expected to generate an additional 10 deliveries per day to the CGO. This estimation of daily deliveries is likely to occur only on occasional days during the peak of the construction period.

These deliveries are assumed to be sourced from:

- West Wyalong access route (8 deliveries per day);
- Forbes access route (1 delivery per day); and
- Condobolin access route (1 delivery per day).

The Modification is expected to increase the number of deliveries to the CGO by approximately 25%, therefore generating an increase of 14 additional delivery trips per day (Appendix H).

The extra deliveries are expected to be sourced from similar locations to the existing deliveries. Consequently, all additional delivery vehicles are assumed to travel to and from the CGO via West Wyalong, using the existing mine access route (Appendix H).

Additionally, 150,000 tonnes per annum of crushed waste rock would be made available on-site for collection by the Bland Shire Council, Forbes Shire Council, Lachlan Shire Council and RMS. The gravel would be transported from the CGO by road between 7.00 am and 6.00 pm, up to seven days per week.

On this basis, and assuming an average load of 25 tonnes per truck, operating over an average of 50 weeks per year, gravel haulage would attract an average of 20 trucks per day to the CGO.

##### Temporary Changes in Routes

As discussed in Section 3.11, the Modification would involve some temporary use of new routes from Forbes and Condobolin at times where existing preferred routes are unavailable (e.g. due to flood inundation or road closures).

##### Traffic Assessment Scenarios

Two future scenarios relating to the Modification traffic have been considered for assessment by GTA Consultants (Appendix H):

- Construction traffic – peak activity is expected to occur during 2020. This will coincide with ongoing operational activity at the CGO consistent with existing conditions, plus the additional activity associated with the Modification.
- Operational traffic – operational activity is expected to reach its future peak level by 2024. This assessment adopts 2024 for the operational assessment scenario to include the cumulative effects of the Modification with unrelated background traffic growth.

**Peak Hour Intersection Performance**

Assessment of intersection performance is based on the ratio of traffic volumes to capacity. The assessment of each scenario shows that all roads proposed for access to the results indicate that the Modification would have negligible impact on the operational performance of the key access routes for the CGO. Drivers would continue to experience good levels of service during the CGO peak hours without need for additional capacity.

**Employee Shuttle Bus Service**

The Modification would be likely to increase the number of passengers using the existing employee shuttle bus service (i.e. the additional employees would use the employee shuttle buses instead of driving). If all the additional employees utilise the existing shuttle bus services there would be an almost negligible increase in external traffic (Appendix H).

**Road Safety**

Appendix H has examined the likely road transport implications of the Modification. It is concluded that the Modification can be satisfactorily accommodated by the road network, with acceptable impacts on the capacity, condition, safety and efficiency of the road network, subject to consideration of road treatment measures described in Section 4.9.3.

**Transport of Hazardous Materials**

Transport of hazardous materials would continue to be undertaken in accordance with the ADG Code.

**4.9.3 Mitigation Measures and Management****Traffic Minimisation**

Evolution would continue to encourage use of the existing employee shuttle bus service for employees and contractors.

The adequacy of the existing employee shuttle bus service would be monitored and modified as necessary when the exact distribution of the sources of the new employees is established. If required, buses with additional seating capacity would be used to transport the additional employees (i.e. the number of bus movements would remain the same).

**Road Treatment Measures**

GTA Consultants has recommended a number of minor road treatment measures for the Modification to correct/upgrade aspects of the local road network consistent with Ausroads guidelines (Appendix H). These measures would be implemented subject to:

- Consultation with the relevant Council to confirm in-principle support for the recommended road treatment measures.
- Implementation of these measures by Council (noting that some of the measures are only triggered when the alternative routes are used by Evolution).
- Funding of the road treatment measures within the framework of the existing Memorandum of Understanding between Evolution, Bland Shire Council, Lachlan Shire Council and Forbes Shire Council.

Measures proposed are described Table 4-20.

**Preparation of a Traffic Management Plan**

A Traffic Management Plan would be prepared and implemented in consultation with the Bland Shire Council, Lachlan Shire Council and Forbes Shire Council and RMS to manage the movement of trucks transporting gravel from the CGO during haulage campaigns.

A Construction Traffic Management Plan would also be prepared and implemented to manage the heavy vehicles associated with the pipeline construction.

**4.10 SOCIO-ECONOMICS**

A Socio-Economic Assessment for the Modification was undertaken by Gillespie Economics (2018) and is presented in Appendix I.

**Cost Benefit Analysis**

The cost benefit analysis estimated the incremental (i.e. in comparison to the approved CGO) net production benefits of the Modification to Australia (over and above the economic benefits of the approved CGO) to be some \$62 M (present value) and to NSW to be some \$27 M (Appendix I). Therefore, any environmental, social or cultural impacts of the Modification to NSW, or Australia, after mitigation, would need to be valued at more than \$27 M and \$62 M, respectively, for the Modification to be undesirable from an economic efficiency perspective (Appendix I).

**Table 4-20**  
**Road Treatment Measures Proposed**

Road/Intersection	Measure Proposed
Bena Street between Wamboyne Road and Burcher	The existing typical layout of may be retained, subject to localised widening of Bena Street and Lake Cowal Road on approach to Wamboyne Road to allow vehicles to pass in the vicinity of the intersection. Should Bena Street be upgraded to provide a sealed surface sufficient for two-way traffic, this would be designed and constructed in accordance with Austroads guidelines and in consultation with Lachlan Shire Council.
Wamboyne Road between Blow Clear Road and Bena Street	Maintenance of guide posts to meet Austroads requirements.
Cowal Road at the intersection with Bonehams Lane and the CGO Access Road	Install give way lines across Lake Cowal Road at the intersection with Bonehams Lane and the CGO Access Road to supplement the give way signs.
90-degree bend in Bonehams Lane	Improve signage at the with chevron alignment markers or similar.
Bonehams Lane at Blow Clear Road	Install give way line.
Blow Clear Road on approach to Wamboyne Road	Replace the non-compliant crossroad warning sign with a give way ahead (W3-2) sign.
Wamboyne Road into Blow Clear Road	Upgrade the pavement for left, and upgrade intersection signage and linemarking.
Wamboyne Road (north) at its intersection with Wamboyne Road (southwest) and Fitzgerald Road	Install give way signs and line marking across, and replace the non-compliant sight board.
Wamboyne Road at its intersection with Bena Street and Lake Cowal Road	Install give way signs and line marking.
Lonergans Lane at Blow Clear Road	Install give way signs and line marking.
Lonergans Lane on its immediate approach to Blow Clear Road	Seal for approximately 20 m.
Bodells Lane on its immediate approach to Newell Highway	Seal for approximately 20 m.

Source: Appendix H.

The cost benefit analysis also considered potential residual impacts associated with greenhouse gases, noise, biodiversity, air quality, road transport, road transport noise, blasting, groundwater, surface water, Aboriginal heritage, aquatic ecology and visual amenity (Appendix I).

Land opportunity costs associated with the biodiversity offset for the Modification were internalised into the production costs of the Modification (Appendix I).

The main quantifiable environmental impacts of the Modification (not included in the Modification production costs) relate to greenhouse gas emissions. These incremental impacts to Australia are estimated at some \$0.4 M and to NSW at some \$0.1 M, which is considerably less than the estimated net production benefits of the Modification (Appendix I). There are also indirect benefits of the Modification to workers and suppliers (Appendix I).

Overall, the Modification is estimated to have net benefits to Australia and NSW of \$101 M and \$60 M, respectively, and hence is justified from an economic efficiency perspective (Appendix I).

#### **Regional Economic Impacts**

Regional economic activity can be measured in terms of a range of economic indicators such as business turnover, value-added, wages and employment. Regional economic activity associated with the CGO arise from (Appendix I):

- the CGO itself being located within the region and the direct economic activity that it brings including direct employment and wages;
- expenditure by the CGO on inputs to production that can be sourced from the region such as repairs and maintenance etc.; and
- expenditure of employee wages in the regional economy.

The Modification will not extend the life of the CGO. However, it would have five main potential impacts for the regional economy (Appendix I):

- Increase the profitability of the CGO and hence its resilience to external factors such as declines in gold prices. This increases the certainty around the CGO continuing to provide economic activity to the region.
- Increases the non-labour operating costs of the CGO by on average \$22 M per annum. To the extent that some of this can be captured by regional suppliers, there would be increased economic activity in the regional economy.
- Increase in permanent employment and wages in the region. The Modification would result in a minor increase (approximately 10 people) to the average and peak workforce employed at the CGO. Provided these jobs are filled by the local workforce or people migrating into the region, it would add to the economic activity in the region.
- Increase in short term employment and economic activity in the region during construction. In 2019 there would be a short term construction period involving up to 100 additional workers for the road and pipeline construction. While the majority of the workforce are likely to only temporarily locate in the region, accommodation and other expenditure of these workers would add to the economic activity in the region.
- A small loss in economic activity as agricultural land is preserved as biodiversity offsets.

### **Community Infrastructure**

The Modification provides for the continued employment of the current workforce. Additionally, the Modification will result in 10 additional direct jobs which may be associated with a potential direct population increase of 24 people. The region, and particularly Lachlan and Bland LGAs, has been experiencing long term population decline. This is likely to have resulted in some spare capacity in community infrastructure and services. Consequently, any additional minor population gain in the region is unlikely to place any strain on existing community infrastructure (Appendix I).

In contrast, it may slow the decline of the regional population and hence slow any overall decline in the provision of community infrastructure and services to the region (Appendix I).

### **Cessation of the CGO**

Consistent with the existing CGO Development Consent (DA 14/98), prior to closure of the CGO, Evolution would work with local shire councils and the community to prepare a workforce phase-out plan to minimise potential impacts associated with CGO employment cessation (Appendix I).

## **4.11 OTHER ENVIRONMENTAL ASPECTS**

A description of additional impacts to the Modification is outlined in the sections below, relating to Greenhouse Gas Emissions (Section 4.11.1), Blasting (Section 4.11.2), Road Traffic Noise (Section 4.11.3), Historic Heritage (Section 4.11.4) and Hazard and Risk (Section 4.11.5).

### **4.11.1 Greenhouse Gas Emissions**

A greenhouse gas emissions inventory for the Modification has been prepared by PEL (2018) and is presented in Appendix F.

In accordance with the *National Greenhouse Accounts (NGA) Factors* (DEE, 2017) direct greenhouse emissions are referred to as Scope 1 emissions, and indirect emissions are referred to as Scopes 2 and 3 emissions.

The major sources of greenhouse gas emissions associated with the Modification include carbon dioxide and methane, which are formed and released during the combustion of fuels used on-site, including the following:

- fuel consumption during mining operations (Scope 1);
- use of explosives during mining operations (Scope 1);
- on-site electricity use (Scope 2);
- production and transport of fuels (Scope 3); and
- electricity lost in transmission and distribution networks (Scope 3).

Annual average Scope 1 emissions for the Modification (including the approved CGO) are estimated to be approximately 39,119 tonnes of carbon dioxide equivalent (Appendix F).

Evolution would continue to calculate and report annual greenhouse gas emissions and energy consumption from the CGO in accordance with its existing requirements under the Commonwealth National Greenhouse and Energy Reporting System (Appendix F).

#### 4.11.2 Blasting

##### **Existing Compliance and Complaints**

Potential impacts associated with blasting at the existing CGO are monitored and managed in accordance with the BLMP. Blast monitoring (ground vibration and overpressure) for every blast is conducted at the locations shown on Figure 2-3.

From the date of submission of the Mine Life Modification in November 2016 to January 2018, blast monitoring indicated that ground vibration and overpressure levels associated with blasting at the CGO were compliant with relevant Development Consent (DA 14/98) criteria at privately-owned receivers.

A total of two blast-related complaints were received from November 2016 to January 2018. Investigations undertaken in response to each blast-related complaint indicated that in each case the CGO was operating in accordance with relevant ground vibration and overpressure criteria.

##### **Potential Impacts**

The typical blast design details and the average blasting frequency for the existing CGO operations would remain unchanged for the Modification (Section 3.3), and the location of blasts would not change relative to privately-owned receivers.

Therefore, the blasting impacts of the Modification would be similar to those currently approved, and compliance with relevant blast overpressure and vibration criteria is expected to continue at all privately-owned receivers (Appendix E).

##### **Mitigation and Management**

Blast monitoring and management would continue in accordance with the currently approved BLMP.

#### 4.11.3 Road Traffic Noise

There would be an increase in existing annual traffic movements to/from the CGO on the surrounding road network due to the Modification (Section 4.9).

Renzo Tonin & Associates (2018) has assessed potential road traffic noise impacts associated with the CGO incorporating the Modification to reflect *NSW Road Noise Policy* (DECCW, 2011) which replaced the Environmental Criteria for Road Traffic Noise on 1 July 2011.

Exceedance of the *NSW Road Noise Policy* (DECCW, 2011) daytime criteria of 60 dBA  $L_{eq(15hour)}$  and night-time criteria of 55 dBA  $L_{eq(9hour)}$  is predicted for receivers along Newell Highway for both Year 16 (2020) and Year 20 (2024) (61 dBA for daytime and 56 dBA for night-time criteria respectively for both years). However, predicted traffic noise levels at these receivers have not increased from those predicted for the currently approved CGO.

No additional exceedance is predicted at any other relevant receiver adjacent to the preferred mine access route (i.e. Ungarie, Wamboyne and Blow Clear Roads) (Appendix E).

#### 4.11.4 Historic Heritage

No registered historic heritage items would be potentially impacted by the Modification.

The only historic heritage items in the ML 1535 area and surrounds listed as heritage items under the Bland LEP were the Cowal West Homestead and Shearing (Wool) Shed. Demolition of the Cowal West Homestead Complex (i.e. the Homestead, Shearing Shed and Hayshed) was approved for the *Cowel Gold Mine E42 Modification Modified Request Environmental Assessment* (Barrick, 2008), and occurred during 2011 to 2012. The relocation and reconstruction of the Shearing Shed at the Lake Cowal Conservation Centre was completed in April 2013.

#### 4.11.5 Hazard and Risk

##### **Hazard Identification and Risk Assessment for the Modification**

Potentially hazardous materials are handled, used and transported everyday at the CGO and their management is documented in the CGO's HWCMP and CMP.

No change to the cyanide consumptions rate per tonne of primary/oxide ore would occur for the Modification, however annual use would increase in line with the increased ore processing rate (Section 3.5.1) Additional deliveries of dangerous goods would be undertaken in accordance with the ADG Code.

Notwithstanding, no new reagents/process consumables would be used, and no change to handling procedures would be required for the Modification.

The handling and storage of process consumables on-site would continue to be undertaken in accordance with measures detailed in the CGO's HWCMP and the CMP.

In addition, and as described in Section 3.5.2, the Modification would not change:

- the existing cyanide destruction methods currently used at the CGO (i.e. either Caro's Acid or the INCO process) (Section 2.3.2); or
- the approved  $CN_{WAD}$  concentration limits of the aqueous component of the tailings slurry stream (Section 2.3.2).

The mitigation and management measures described in the CMP (including the cyanide monitoring process) would continue to be implemented for the Modification.

Given the above, the Modification would not change the potential impact mechanisms to the public and public property, and their associated consequences of likelihoods, to the extent that risk levels would change from those previously assessed in the Preliminary Hazard Analysis (PHA), HAZOP or FHA.

#### **Hazard Prevention and Mitigation Measures**

Hazard prevention and mitigation would continue to be implemented for the Modification in accordance with the recommendations and management measures detailed within existing management plans, assessments and studies, including the PHA, HAZOP, FHA, Fire Safety Study, Safety Management System, ERP/PIRMP, BLMP, CMP and Hazardous Waste and Chemical Management Plan.

Notwithstanding, relevant management plans would be reviewed and if necessary revised to reflect any additional changes associated with the Modification.

A summary of the relevant management plans, assessments and studies is provided below.

#### **Preliminary Hazard Analysis**

A PHA conducted as part of the original EIS analysed the off-site risks to the environment, public safety and public property of potential hazardous events. The study ranked the risks and reviewed the adequacy of the safeguards and recommended improvements where necessary.

The PHA concluded that the highest risks to the environment, public safety and public property from the approved CGO were associated with the following scenarios (ANSTO Safety and Reliability, 1997):

- spillage of material during transport;
- a major spillage of material from on-site storage tanks coincident with catastrophic bund failure;
- spillage of diesel fuel onto the ground outside the mine site;
- wildlife entering the TSFs following damage to the fence;
- birds using the TSFs when an accidental release of cyanide occurs; and
- release of hazardous material in the event of a fire.

The PHA included a number of recommended risk reduction measures relevant to the environment and public safety that have been incorporated into the approved CGO design to reduce the likelihood or the consequences of incidents that could cause damage.

The recommended risk reduction measures relevant to the environment and public safety have been incorporated into relevant approved CGO management plans and implemented, as outlined below. No hazardous events or incidents have occurred at the CGO since the commencement of operations that have changed the assumed consequence and likelihood ratings described in the PHA.

#### **Hazard and Operability Study**

In accordance with the Hazard Industry Planning Advisory Page No. 8 *HAZOP Guidelines* (NSW Department of Planning [DoP], 2011a) and as agreed with the former Department of Planning (now the DP&E), the scope of the HAZOP study included storage and/or handling areas of the approved CGO relevant to dangerous goods, hazardous materials and/or materials with the potential for off-site impact.

The HAZOP included a review of the monitoring, control, alarm and shutdown systems associated with the cyanide process. Control measures to maintain cyanide concentrations within compliance levels were also proposed. No hazardous events were determined during the study that had not been previously known and which had the potential for significant off-site risk (Pinnacle Risk Management, 2004a).

### *Final Hazard Analysis*

A FHA was also conducted for the approved CGO and was designed to extend and update the analysis in the PHA. Major findings of the FHA are summarised below (Pinnacle Risk Management, 2004b):

- For the storage quantities of dangerous goods and hazardous materials on-site that had increased since the PHA, there was no measurable change to the site's risk profile.
- As per the findings in the PHA, off-site risk to the environment and public was dominated by transport related incidents. The higher risk materials include sodium cyanide, ammonium nitrate, sulphuric acid, hydrogen peroxide and liquified petroleum gas.
- The cyanide control measures to prevent cyanide concentrations increasing in the tailings storage facility presented in the HAZOP were considered acceptable.
- Two additional hazardous materials were assessed (i.e. sodium metabisulphite and copper sulphate) and concluded to pose no significant risks.
- As per the PHA, the site bunding system was seen as a very effective barrier to prevent on-site spills causing potential off-site environmental impact.

Overall, the FHA concluded that the approved CGO complied with the HIPAP No. 4 *Risk Criteria for Land Use Safety Planning* (DoP, 2016), and HIPAP No. 6 *Guidelines for Hazard Analysis* (DoP, 2011c) guidelines for tolerable fatality, injury, irritation and societal risk (Pinnacle Risk Management, 2004b). The FHA also concluded the risks to the biophysical environment, the risk of propagation and the potential impact on cumulative risks in the area from releases were considered to be generally negligible (Pinnacle Risk Management, 2004b). Overall, the assessment concluded that the CGO would not pose any unacceptable levels of risk (Pinnacle Risk Management, 2004b).

No hazardous events or incidents have occurred at the approved CGO since the commencement of operations that have changed the assumed consequence and likelihood ratings described in the FHA.

### *Fire Safety Study*

A Fire Safety Study was conducted for the approved CGO and its objective was to assess the proposed fire prevention, detection, protection and fighting measures for appropriateness for specific fire hazards and adequacy to meet the extent of potential fires at the process plant (Pinnacle Risk Management, 2005). No further actions to those detailed in the HAZOP were recommended in the Fire Safety Study.

### *Safety Management System*

A Safety Management System has been developed for the approved CGO in accordance with HIPAP No. 9 *Safety Management* (DoP, 2011d). The Safety Management System sets out a comprehensive system that covers all on-site operations and associated transport activities involving hazardous materials. The Safety Management System describes all safety related procedures, responsibilities and policies, and identifies mechanisms designed to assist in adherence to procedures.

### *Emergency Response Plan/Pollution Incident Response Plan*

Emergency response procedures for a range of potential emergency situations (e.g. fires, explosions, spills, natural disasters, etc.) that could occur at the CGO have been documented in the ERP. The ERP includes provision for annual review to assist in the identification of any new potential hazards as well as opportunities to improve the effectiveness of control measures, if required.

In accordance with the requirements of Part 5.7A of the NSW *Protection of the Environment Operations Act, 1997* (POEO Act), a PIRMP is required for the CGO. The EPA accepted the CGO's approved ERP as the PIRMP on 12 September 2012.

### *Blast Management Plan*

The BLMP outlines provisions relating to notification procedures of blast times, blast design/control and a blast monitoring programme. Strategies and procedures in the event of airblast overpressure or ground vibration criteria exceedances are also outlined in the management plan, including the implementation of remedial measures.

### *Cyanide Management Plan*

The CMP includes hazard prevention and mitigation measures, particularly with regards to potential risks to fauna associated with the use of cyanide. Measures included in the CMP include the implementation of a cyanide monitoring programme, contingency measures for cyanide reduction, fauna visitation deterrence measures at the TSFs, and cyanide storage and handling procedures.

### *Hazardous Waste and Chemical Management Plan*

Hazard prevention and mitigation measures relevant to hazardous wastes and chemicals have been documented in the HWCMP. The management plan also requires the maintenance of a fuel and oil register and a hazardous substances and dangerous goods register.

The HWCMP and associated strategies, inventories and registers have been developed to facilitate efficient audit functions by providing audit criteria that would be used to evaluate the effectiveness of hazard prevention and mitigation measures.