COWAL GOLD OPERATIONS

2016 ANNUAL REVIEW

COWAL GOLD OPERATIONS
2016 Annual Review

Name of Operation	*Cowal Gold Operations*
Name of Operator	*Evolution Mining (Cowal) Pty Limited*
Development Consent	*DA 14/98*
Name of Holder of Development Consent	*Evolution Mining (Cowal) Pty Limited*
Mining Lease #	*ML 1535*
Name of Holder of Mining Lease	*Evolution Mining (Cowal) Pty Limited*
Environmental Protection Licence #	*EPL11912*
Name of Holder of EPL	*Evolution Mining (Cowal) Pty Limited*
Water Licence #	*WAL 36569, WAL 31864, WAL 36615, WAL 36617, WAL 13749, WAL 14981, WAL 13748*
Name of Holder of Water Licence	*Evolution Mining (Cowal) Pty Limited*
MOP Start Date	*1 September 2016*
MOP End Date	*31 August 2018*
Annual Review Start Date	*1 January 2016*
Annual Review End Date	*31 December 2016*

I, Jamie Coad, certify that this audit report is a true and accurate record of the compliance status of the Cowal Gold Operations for the period 1 January – 31 December 2016 and that I am authorised to make this statement on behalf of Evolution Mining (Cowal) Pty Limited.

Note.

a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.

b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or $22,000, or both).

Name of Authorised Reporting Officer	*Jamie Coad*
Title of Authorised Reporting Officer	*Manager - Health, Safety, Environment and Social Responsibility*
Signature of Authorised Reporting Officer	
Date	*27 July 2017*

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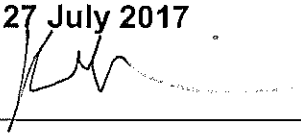
Signature	
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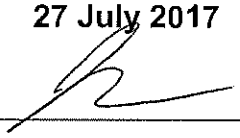
Signature	

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1 STATEMENT OF COMPLIANCE

The compliance status of the Cowal Gold Operations (CGO) with its relevant approval conditions at the end of the reporting period (31 December 2016) is provided in Table 1.

Table 1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent DA 14/98	YES
Environmental Protection Licence (EPL) 11912	YES
Mining Lease (ML) 1535	YES

2 INTRODUCTION

The 2016 Annual Review (AR) has been prepared by Evolution Mining (Cowal) Pty Limited (Evolution) for the CGO in accordance with the requirements of Condition 9.1(b) of the Development Consent DA 14/98 for the CGO (granted on 26 February 1999) (Development Consent) and Condition 26 of the Conditions of Authority for ML 1535 (granted on 13 June 2003). This AR is also consistent with the New South Wales (NSW) Government's (2015) *Annual Review Guideline – Post-approval Requirements for State Significant Mining Developments*.

2.1 CGO BACKGROUND

The CGO is a gold-silver mine owned and operated by Evolution and is located approximately 38 kilometres (km) north-east of West Wyalong, NSW (Figure 1). The land immediately adjacent to and surrounding the CGO consists of Lake Cowal and farming land (Figure 2 shows the land tenure of properties in the vicinity of the CGO). A satellite image of the CGO was captured in August 2016 and is presented on Figure 3, which also presents the current operational disturbance footprint and general arrangement of the CGO components. Land preparation areas and the extent of rehabilitation during the reporting period is presented on Figure 4, while the offset areas are presented on Figure 5.

North Limited (North) commenced exploration along the western side of Lake Cowal in 1981. From 1981 to 1994, exploration was concentrated on the Endeavour 42 (E42) ore body to increase the size and confidence of the resource by infill and deep drilling.

North received Development Consent for the Cowal Gold Project in February 1999. North was later acquired by Rio Tinto which subsequently sold the Cowal Gold Project to Homestake Australia Limited (Homestake). Homestake commenced advanced drilling on E42 in late 2001. In December 2001, Barrick (Cowal) Pty Ltd (Barrick) acquired Homestake and its operating subsidiary. Barrick continued the drilling programme of the E42 ore body between 2001 and 2005. During 2003 and 2004, the CGO underwent a detailed design phase and construction commenced on 12 January 2004. Mining operations commenced in April 2005, followed by operation of the final stage of the open pit dewatering system in June 2005. Processing operations commenced in April 2006. Evolution acquired Barrick on 24 July 2015.

2.2 MINE CONTACTS

Contact details for key Evolution employees are provided below:

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The street and postal address for the CGO is provided below:

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LAKE COWAL NSW 2671

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PO Box 210
WEST WYALONG NSW 2671

3 APPROVALS

3.1 CURRENT LIST OF CONSENTS, LEASES, LICENCES AND PERMITS

The key consents, leases, licences and permits under which the CGO operates are presented in Table 2. Any applicable changes to these approvals during the reporting period are also outlined in Table 2.

Table 2: Key Consents, Leases, Licences and Permits

Instrument	Relevant Authority	Date of Grant	Expiry Date	Last Issue Date	Changes During AR Period
Development Consent (DA 14/98)	DP&E	26/02/1999	31/12/2024	22/07/2014	Submitted Modification 13 to the DP&E for an extension to the approved operational mine life from 2024 to 2032. Determination on this modification was pending at the end of the reporting period.
Development Consent (DA2011/64) (Eastern Saline Borefield [ESB])	FSC	20/12/2010	Life of ML	2010	Nil
Mining Lease (ML 1535)	DRG	13/06/2003	13/06/2024	13/06/2003	Nil
Environment Protection Licence (EPL 11912)	EPA	23/12/2003	N/A	3/09/2015	Evolution submitted a licence variation on 5/8/2016 to update the EPL as a result of the approval of the air quality, blast, surface water and groundwater monitoring programmes. The variation also requested contemporisation of the cyanide sampling methods defined in condition M2.3. The EPL variation remained pending at the end of the reporting period.
Permit #1361 under section 87(1) of the NPW Act	OEH	23/05/2002	Life of ML	2002	Nil
Consent #1467 under section 90 of the NPW Act	OEH	27/11/2002	Life of ML	2002	Nil
Permit #1468 under section 87(1) of the NPW Act	OEH	27/10/2003	Life of ML	2003	Nil
Consent #1680 under section 90 of the NPW Act	OEH	28/07/2003	Life of ML	2003	Nil
Permit #1681 under section 87(1) of the NPW Act	OEH	28/07/2003	Life of ML	2003	Nil
Bland Creek Palaeochannel (BCPC) borefield Water Access Licence (WAL) 31864 Water supply work approval 70WA614076	DPI-Water	14/09/2012	13/9/2025	2015	Nil
Eastern Saline Borefield WAL 36569 Water supply work approval 70WA614933	DPI-Water	10/06/2011	09/06/2026	14/09/2014	Nil

Table 2 (Continued): Key Consents, Leases, Licences and Permits

Instrument	Relevant Authority	Date of Grant	Expiry Date	Last Issue Date	Changes During AR Period
Saline groundwater supply borefield within ML 1535 WAL 36615 Water supply works approval 70WA614090	DPI-Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering bores WAL 36615 Water supply works approval 70WA614090	DPI-Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering bores WAL 36617 Water supply works approval 70WA614090	DPI-Water	21/03/2014	13/09/2025	13/9/2015	Nil
Monitoring and test bore licences	DPI-Water	Various	Various	2015	Nil
High Security Title WAL13749	DPI-Water	21/12/2006	Life of ML	2006	Nil
High Security Title WAL14981 (80 Units)	DPI-Water	15/09/2011	Life of ML	2011	Nil
General Security WAL13748	DPI-Water	21/12/2006	Life of ML	2006	Nil
Lake Cowal pipeline and Temporary Isolation Bund and Lake Protection Bund structures Water Supply Works Approval 614805	DPI-Water	12/01/2010	13/9/2025	13/9/2015	Nil
NSW Dangerous Goods Acknowledgement (NDG037143)	WorkCover	2005	Life of ML	2005	Ongoing – upon change basis since 2015.

DP&E: NSW Department of Planning and Environment.

DPI-Water: Department of Primary Industries – Water.

DRG: Division of Resources and Geoscience – within the Department of Planning and Environment.

EPA: NSW Environmental Protection Authority.

FSC: Forbes Shire Council.

NPW Act: NSW *National Parks and Wildlife Act 1974.*

OEH: NSW Office of Environment and Heritage.

3.2 STATUS OF ENVIRONMENTAL MANAGEMENT PLANS REVIEW

The following Environmental Management Plans (EMPs) were approved by the DP&E during the reporting period:

- Air Quality Management Plan (AQMP);
- Flora and Fauna Management Plan (FFMP);
- Soil Stripping Management Plan (SSMP);
- Rehabilitation Management Plan (RMP) (approved by the then Division of Resources and Energy [DRE] and appended to the Mining Operations Plan [MOP]);
- Addendum to the Erosion and Sediment Control Management Plan (ESCMP); and
- Addendum to the Land Management Plan (LMP).

At the end of the reporting period, the following EMPs were awaiting approval:

- Addendum to the Monitoring Programme for Detection of any Movement of Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls (submitted in May 2015);
- Addendum to the Indigenous Archaeology and Cultural Heritage Management Plan (IACHMP) (submitted May 2015);
- Rehabilitation Strategy (as provided in Section 3.2 of the RMP) (submitted in April 2015);
- Environmental Management Strategy (submitted November 2016);
- A further revision to the FFMP (submitted November 2016); and
- Biodiversity Offset Management Plan (BOMP) (submitted November 2016).

4 OPERATIONS SUMMARY

4.1 MINING AND PROCESSING OPERATIONS

During the reporting period, mining operations from the E42 open pit continued as per relevant approvals outlined in Section 3.1. The processing plant also operated as per all relevant approvals. A summary of key production statistics for the reporting period are provided in Table 3 below.

Table 3: Production Summary

Material	Approved Limit	2015 AR	2016 AR	2017 AR (Forecast)
Ore (t)	N/A	9,669,118	9,213,744	10,201,054
Mineralised Waste (t)	N/A	1,015,835	853,425	823,572
Waste Rock (t)	N/A	4,997,458	2,211,263	6,103,159
Northern Waste Rock Emplacement (NWRE) (m AHD)	308[1]	278	268[3]	268[4]
Southern Waste Rock Emplacement (SWRE) (m AHD)	283[1]	254	254	273
Perimeter Waste Rock Emplacement (PWRE) (m AHD)	233[1]	225	225	225
Tailings Storage Facilities (TSFs)				
Northern TSF (NTSF) (m AHD)	248[1]	231.7	236	236
Southern TSF (STSF) (m AHD)	255[1]	239	239	243.7
Mill Throughput (Mtpa)	7.5[2]	7.4	7.2	7.1
Saleable Product (oz)	N/A	257,311	273,055	240,517

[1] Development Consent Condition 1.2(c).

[2] Development Consent Condition 1.2(b).

[3] The height of the NWRE during the reporting period was 268 m AHD, however a temporary ore stockpile on the emplacement is at the height of 288 m AHD.

[4] The height of the NWRE during the next reporting period is expected to be 268 m AHD, however a temporary ore stockpile on the emplacement is expected remain at the current height of 308 m AHD.

t – tonne; m AHD – metres Australian Height Datum; Mtpa – million tonnes per annum; Oz – ounce.

4.1.1 Mining

Mining of the open pit during the reporting period occurred only in Stage G from Relative Level (RL) 966 metres (m) to RL 912m, representing a vertical advance of 54 m.

Vertical dewatering systems were maintained throughout the reporting period. Horizontal holes were drilled as mining progressed through Stage G in order to de-pressurise specific areas in January, June and July 2016.

Run-of-mine (ROM) 8 and ROM 9 were constructed on top of the NWRE at 1,268 m RL in February and August 2016 respectively.

Waste rock mined from the open pit was stockpiled for the NTSF Stage 5 and STSF Stage 6 lift works, and outer slope rehabilitation on the waste emplacements. Rock buttressing associated with the Stage 5 NTSF lift occurred during 2016 using ROM waste rock.

As per condition 1.2(d) of the Development Consent, construction works on the TSF embankments is permitted to be undertaken during the hours of 7am-6pm, seven days per week. During the reporting period, construction was undertaken on the NTSF Stage 5 lift Monday – Saturday during the permitted hours. The Stage 5 lift commenced in February and was completed in December 2016.

There were no major changes to the E42 pit, infrastructure or mining fleet during the reporting period. However, during the next reporting period a pit expansion is planned which will likely include some infrastructure changes, increases in mining fleet and production rates, including expansion of the NWRE and construction of the Up Catchment Diversion System (UCDS) haul road crossing.

4.1.2 Processing

Processing continued throughout the reporting period. No changes to the processing operation took place during the reporting period. Construction of the floats tail leach circuit upgrades within the process plant is expected to commence during the next reporting period.

Tailings were deposited into the Stage 5 lift (4th augmentation) of the STSF during the reporting period. Construction works continued on the Stage 5 lift (4th augmentation) of the NTSF in the reporting period.

In accordance with Development Consent Condition 5.3(a), cyanide levels in the aqueous component of the tailings slurry stream did not exceed 20 mg cyanide weak acid dissociable per litre (CN_{WAD}/L) (90 percentile over six months), and 30 mg CN_{WAD}/L (maximum permissible limit at any time at the process plant).

4.1.3 Exploration

Exploration activities within ML 1535 undertaken during the reporting period included exploration and resource development drilling within and surrounding the main E42 open pit and proximal deposits, including the Endeavour 46, Galway/Regal and Endeavour 41 deposits.

A total of approximately 66,500 m of drilling was completed within ML 1535 during the reporting period including:

- 7,500m in-pit RC drilling.
- 2,000m air-core drilling.
- 57,000m diamond drilling.

A vast majority of the diamond drilling was conducted from collar locations within the active mining areas of the CGO, leading to no additional ground disturbance. The air-core drilling programme within the Lake Cowal area utilised a truck mounted rig with water retention equipment that prevents spillage of fluids onto the ground surface. The water retention equipment includes a collar tray around the collar, all return-water from the hole diverted into barges for storage and disposal, a sampling unit situated over a tank to contain any water, and a mobile bund unit placed under the rig to contain any possible leakage. With the exception of the in-pit RC drilling, all holes were fully cement grouted. Land disturbance within ML 1535 was minimal as a result of the exploration activities, and rehabilitation of the drilling areas was undertaken on completion of each program.

Exploration and resource development drilling is expected to continue within ML 1535 throughout 2017, and is outlined in the currently approved MOP. Geotechnical drilling is also proposed to be undertaken during 2017, including drilling around the NTSF and STSF.

4.1.4 Hazard Audit

The third triennial Hazard Audit occurred between the 16th and 18th of May 2016 and was conducted by an independent qualified person (Dean Shewring of Pinnacle Risk Management), in compliance with the NSW Department of Planning's *Hazard Audit Guidelines* (2011). A total of nineteen recommendations were made and have been tracked in the CGO's Environmental Obligations Register.

The next Hazard Audit is scheduled for 2019.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The *2015 Annual Review* meeting was held on 12 October 2016 at the CGO. There were no actions arising from this meeting. No additional directions were given during site visits within the reporting period.

6 ENVIRONMENTAL PERFORMANCE

Environmental management at the CGO during the reporting period has been conducted under the guidance of and in accordance with the EMPs prepared for the CGO, required under the Development Consent.

Overall Performance against Licences, Approvals and Environmental Management Plans and Effectiveness of Environmental Management

The 2016 Independent Environmental Audit (IEA) was conducted between 26 and 29 April 2016 by Trevor Brown and Robert Drury of Trevor Brown & Associates, Michael Frankcombe of WPS Parsons Brinkerhoff (rehabilitation) and Mathew Richardson of Niche Environment and Heritage (ecology and biodiversity) to assess compliance with the requirements of the CGO's relevant approvals, licences and EMPs. The IEA results generally confirmed a high degree of compliance with the Development Consent conditions, EPL 11912 conditions and requirements of the Conditions of Authority for ML 1535. The 2016 IEA is provided on Evolution's website - http://evolutionmining.com.au/cowal/.

Evolution has fully complied with the commitments of the DRE (now DRG) approved MOP during the reporting period.

The EPL 11912 Annual Return for the 23 December 2016 to 22 December 2016 reporting period was submitted to the EPA on 17 February 2017. In the 2016 Annual Return, Evolution identified non-compliances related to monitoring not being undertaken at some surface water, dust, groundwater and blast monitoring points. The reasons for the non-compliances were inaccessibility of monitoring points due to weather and/or safety, dry bores, no water present in toe drain or equipment failure. A summary of the EPL 11912 non-compliances is provided on the EPA website at: http://www.epa.nsw.gov.au/prpoeoapp/.

Evolution has all the relevant Project Management systems, staffing and consultancy arrangements in place to be in a position of confidence regarding compliance with all relevant licences, approvals and EMPs. Evolution expects to undertake CGO activities for the next reporting year in accordance with all relevant licences, approvals and EMPs. Section 6 discusses the management objectives and targets for the CGO during this and the next reporting period.

Overall, due to Evolution's substantial compliance with the EMPs, environmental management for the CGO during the reporting period has been highly effective.

6.1 AIR QUALITY

Development Consent Condition 6.1(a) details the air quality impact assessment criteria against which air quality monitoring results are compared for the CGO. As required by Development Consent Condition 6.1(c) the CGO AQMP has been prepared, submitted and approved by DP&E (18 February 2016), superseding the former Dust Management Plan.

Monitoring and management of air quality and meteorology during the reporting period was undertaken in accordance with the relevant Development Consent conditions, the approved AQMP and the EPL 11912.

Evolution reported to the National Greenhouse and Energy Reporting Scheme and National Pollutant Inventory for the CGO during the reporting period.

6.1.1 Environmental Management

6.1.1.1 Control Strategies

Air quality safeguards and control strategies were implemented at CGO during the reporting period to minimise dust emissions from mining activities and exposed areas in accordance with the Development Consent conditions, the approved AQMP and the EPL 11912. These control strategies are summarised in Table 4.

Table 4: Air Quality Safeguards and Control Strategies Implemented During the Reporting Period

Source	Control Strategies
Disturbed Surfaces	• Disturbed surfaces were watered using water trucks to suppress dust. • Areas for soil stripping were minimised to reduce the area of exposed ground at any one time.
Access Roads	• Access roads were watered and regularly maintained. • A dust suppressant chemical (PetroTac) was applied to 5 km of unsealed ML 1535 roads around the general Administration and Plant area to reduce dust generation. • Site access routes are clearly marked and workplace inductions specify routes. • The speed of vehicles travelling on unsealed surfaces is restricted.
Soil Stripping	• Access tracks used for soil stripping during the loading and unloading cycle were watered. • Soil stripping was limited to areas required for future mining operations.

6.1.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.1.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.1.2 Environmental Performance

6.1.2.1 Monitoring

Meteorological Monitoring

The CGO Automatic Weather Station (AWS) meteorological station located near the southern ML 1535 boundary, collected meteorological data throughout the reporting period. The station measures real-time wind speed and direction, standard deviation of wind direction, temperature (2 m, 10 m), barometric pressure, humidity, solar radiation and rainfall. The CGO AWS is supported by quarterly independent maintenance and calibration, as well as production of monthly data reviews by Sentinel Pty Ltd.

Monthly total rainfall measured at the CGO AWS is shown in Table 5. Total annual rainfall for the reporting period was 603.2 millimetres (mm). Large rainfall events began June and continued through to September, causing localised flooding and the inundation of Lake Cowal.

Other parameters recorded by the CGO AWS meteorological station during the reporting period are presented in Table 6.

Annual and monthly wind roses from the CGO AWS are presented in Figures 6a and 6b.

Air Quality Monitoring

During the reporting period, dust monitoring was carried out in accordance with the AQMP utilising depositional (static or gravimetric) and high-volume Total Suspended Particulate (TSP) sampling equipment.

A network of 18 static dust deposition gauges was used throughout the reporting period to collect monthly dust samples. These dust gauges are located at varying distances from the CGO open pit, and in a range of directions from the pit (Figure 7). A number of the gauges are situated near homesteads of properties that adjoin the CGO, and a number are also located within Lake Cowal near bird breeding areas. A high-volume air sampler (HVAS) (HV1) at the 'Coniston' Homestead to the north of the CGO collects suspended particle data, operating for 24 hour periods every 6 days.

Table 5: Monthly Rainfall (mm) Measured at CGO AWS 2010 – 2016

Month	2010 (mm)	2011 (mm)	2012 (mm)	2013 (mm)	2014 (mm)	2015 (mm)	2016 (mm)
January	2.8	24.4	26.6	5.20	32.0	75.8	67.0
February	95.6	138.6	129.2	26.0	23.2	11.0	1.4
March	44.6	146.2	78.0	45.4	71.0	0.4	16.8
April	50.6	20.2	15.6	3.4	20.2	56.8	11.4
May	40.0	22.0	32.6	30.4	21.2	12.8	61.8
June	22.8	29.4	29.6	87.8	59.4	27.2	122.6
July	62.2	11.8	49.8	33.4	9.0	77.2	72.6
August	34.0	41.8	19.0	18.8	10.8	49.0	31.2
September	64.2	13.8	25.0	60.4	16.8	8.6	136.8
October	94.0	31.0	16.0	7.2	15.2	52.6	28.8
November	60.2	130.4	36.4	9.0	1.6	24.6	28.0
December	111.7	135.0	27.0	14.6	48.4	19.2	24.8
TOTAL	**682.7**	**744.6**	**484.8**	**341.6**	**328.8**	**415.2**	**603.2**

Table 6: Monthly Average Meteorological Data (2016)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Humidity (%)	43.48	36.45	43.48	47.87	71.05	81.59	79.02	74.65	76.81	60.53	43.44	45.00
Mean Pressure (mbar)	986	986	990	994	991	991	993	994	988	989	987	985
Mean Wind Direction (^{o})	172.4	174.7	167.4	165.2	218.6	212.7	216.4	195.5	190.7	203.4	199.4	176.3
Mean Wind Velocity (m/s) 15min	3.42	3.39	2.87	2.54	2.67	3.22	2.91	2.51	3.34	3.60	3.51	4.00
2m Temp Min (^{o}C)	11.10	9.42	7.93	5.15	0.42	-1.61	-0.31	-1.49	1.65	1.82	3.72	5.11
2m Temp Max (^{o}C)	47.94	44.48	44.25	36.59	29.08	21.84	26.33	24.98	26.06	34.60	39.29	42.06

% - percentage; mbar – millibar; m/s – metres per second; ^{o} – degrees; ^{o}C – degrees Celsius.

A series of duplicate dust gauges are installed near pre-existing dust gauges (DG01, DG02, DG03, DG04, DG05 and DG13) with dust samples collected and analysed quarterly for metal concentrations. Duplicate dust gauges allow for a longer sampling period and a larger sample size for analysis, and are used to compare and verify monitoring results against the monthly CGO dust monitoring programme.

Air Quality Impact Assessment Criteria

Table 7 details the long-term impact assessment criteria for deposited dust for any residence on privately-owned land as required by Development Consent Condition 6.1(a).

Table 7: Long-term Impact Assessment Criteria for Deposited Dust

Pollutant	Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Deposited dust[1]	Annual	2 g/m²/month[2]	4 g/m²/month[3]

[1] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: *Methods for Sampling and Analysis of Ambient Air – Determination of Particulate Matter – Deposited Matter – Gravimetric Method.*

[2] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).

[3] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

g/m^2/month – grams per square metre per month.

Table 8 and Table 9 detail the long–term and short-term impact assessment criteria for TSP and particulate matter less than (<) 10 µm (PM_{10}) for any residence on privately-owned land as required under Development Consent Condition 6.1(a).

Table 8: Long-term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion [1]
Total suspended particulate (TSP) matter	Annual	90 µg/m³ [2]
Particulate matter < 10 µm (PM_{10})	Annual	30 µg/m³ [2]

[1] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

[2] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

Table 9: Short-term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging Period	Criterion [1]
Particulate matter < 10 µm (PM_{10})	24 hour	50 µg/m³ [2]

[1] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Secretary.

[2] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).

6.1.2.2 Performance Outcomes

Total Suspended Particulates

On an annual average basis, the TSP data collected by the HVAS is well below the EPA (2001) assessment criterion for TSP matter (90 micrograms per cubic metre [µg/m^3]) (Table 8). Compared to previous years, the TSP level in 2016 (33 µg/m^3) is lower than 2015 (36 µg/m^3), 2014 (46 µg/m^3), 2013 (44 µg/m^3), 2012 (34 µg/m^3), 2010 (39 µg/m^3), 2009 (63 µg/m^3) and 2008 (43 µg/m^3); but higher than in 2011 (28 µg/m^3).

In keeping with the previous years of TSP measurements at CGO, there was moderately strong seasonality in the TSP data collected for 2016. For the summer and early-mid autumn months of January, February, March and April, the average TSP was around 54 µg/m^3; for the late autumn, winter and early-mid spring months of May, June, July, August, September and October, the average TSP was around 16 µg/m^3; and for the late spring and early summer months of November and December, the average TSP was around 39 µg/m^3. In 2016, TSP appeared to be strongly negatively correlated with rainfall at CGO.

Particulate matter < 10 µm (PM_{10})

As described in the *Cowal Gold Mine Extension Modification Air Quality Impact Assessment* undertaken by Pacific Environment Limited (PEL) (2013), PM_{10} can be calculated as 40% of measured TSP (NSW Minerals Council, 2000). The annual average TSP collected by the HVAS located at the CGO's nearest residence was 33µg/m^3 (University of Sydney, 2017). Accordingly, the annual average PM_{10} is calculated at 13.2µg/m^3, well below the 30µg/m^3 long term impact assessment criteria (Table 8).

The short term impact assessment criterion for PM_{10} is 50 µg/m^3 (Table 9). No exceedances of the short term impact assessment criterion for PM_{10} of 50 µg/m^3 occurred during the reporting period.

Deposited Dust

Due to high winter and spring rainfall, significant regional flooding and the inundation of Lake Cowal, many of the depositional dust gauges within and surrounding Lake Cowal were inaccessible or inundated during the reporting period. Many of the inundated dust gauges were already mounted on 5 m tripods to raise them above the previous high water mark reached in 2012 (Plate 1). The inundation and inaccessibility of a number of depositional dust gauges significantly influenced the results of the depositional dust monitoring programme during the reporting period. A summary of the dust deposition results for the reporting period is provided in Table 10.

Plate 1: Elevated Depositional Dust Gauge within Lake Cowal

A detailed discussion of the dust monitoring results (including laboratory analysis of dust results) is provided in the University of Sydney's (2017) *Interpretation and Discussion of 2016 Air Quality Monitoring Results Cowal Gold Operations*. A summary of the key findings is provided below (University of Sydney, 2017):

- Eight of the dust deposition gauges were inundated by lake waters at various times during the latter half of the reporting period, invalidating the estimation of deposited dust amount for those gauges during those sampling periods.
- Reflecting the flooding of some gauges with sediment-laden lake water, temporal and spatial variation in reported monthly dust deposition was extreme during the reporting period. Monthly deposition of 10 grams of insoluble solids per square metre (g/m^2) was exceeded 36 times in the reporting period, across 11 different months and across 13 different dust deposition gauges. Of these large deposits, at least 18 were caused by inundation of the dust deposition gauge by sediment-laden lake water.
- Changes in reported dust deposition rates at each gauge were strongly correlated with rainfall and the filling of Lake Cowal during reporting period. Reported average dust deposition was generally low until June (monthly dust deposition rates averaged across all gauges ranged from 1.2 to 5.3 g/m^2), but from July to December reported dust deposition increased (all gauge averages from 5.6 to 18.4 g/m^2) as various gauges became inundated and submerged in lake waters. The September and October sampling periods saw the most gauges submerged and/or inaccessible.
- Compliance with the assessment criterion of 4 g/m^2/month average annual deposited dust was achieved at seven out of 13 gauges during the reporting period. Compliance was achieved at five (DG1, DG4, DG7, DG9, DG10) of the seven gauges located at residences and bird breeding and native flora areas.
- Of the six gauges external to ML 1535 that exceeded the assessment criterion of 4 g/m^2/month, four of these gauges (DG2, DG3, DG5, DG6) were inundated with lake waters for at least one sampling period, substantially increasing the reported average insoluble solids for those locations. For the other two gauges (McLintocks Shed, Lakeside) the cause of the exceedances can largely be attributed to one or two substantial deposits (>10 g/m^2/month) in different months; the McLintocks Shed gauge received 12.6 and 14.6 g/m^2/month during the February and October sampling periods, while the Lakeside gauge received 23.8 g/m^2/month during the September sampling period. In these three deposits, the combustible fraction comprised between 35% and 55% of the total deposit; if these combustible fractions were removed the average dust deposition for these gauges would fall to less than 4 g/m^2/month.

Table 10: Monthly and Mean Dust (insoluble solids) Deposition Rates (2016)

Dust Gauge Site	Monthly Deposition of Insoluble Solids in Dust (g/m^2/month)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Mean**
Private Receiver Locations														
DG1	*1.2*	*0.6*	*2.2*	*1.1*	*0.7*	*0.2*	*0.3*	*1.2*	*1.5*	*7.1*	*3.7*	*2.5*	**1.9**	**1.9**
*DG6**	*1.7*	*0.7*	*1.2*	*1.2*	*0.3*	*0.5*	*18.3*	*1.9*	*8.5*	*8.5*	*8.5*	*13.1*	**5.4**	**4.3**
Locations within Lake Cowal														
*DG2**	*1.8*	*0.4*	*1.3*	*1.1*	*1*	*0.4*	*13.4*	*13.4*	*13.4*	*57.6*	*8.6*	*4.7*	**9.8**	**5.4**
*DG3**	*2.1*	*0.3*	*0.5*	*0.8*	*0.6*	*0.6*	*51.7*	*51.7*	*51.7*	*51.7*	*51.7*	*51.7*	**26.3**	**0.8**
*DG4**	*1.4*	*1.2*	*0.9*	*0.7*	*0.8*	*0.8*	*0.8*	*0.8*	*13.4*	*13.4*	*3.8*	*3.8*	**3.4**	**1.5**
*DG5**	*1.4*	*0.3*	*2.1*	*0.6*	*3.2*	*3.2*	*3.2*	*3.2*	*43.5*	*43.5*	*51.4*	*17.8*	**14.5**	**3.9**
Locations within ML 1535														
DG11^^	*6.5*	*1.6*	*-*	*9.5*	*63.5*	*15.6*	*6.4*	*10.7*	*43.2*	*29.1*	*7.3*	*8.1*	**18.3**	**18.3**
DG12^^	*9.4*	*1.6*	*-*	*4.9*	*0.9*	*0.9*	*2.1*	*1.5*	*7.1*	*17.7*	*6.6*	*6.4*	**5.4**	**5.4**
*DG13**	*22*	*0.9*	*1.1*	*1.1*	*0.8*	*0.4*	*2*	*0.3*	*25.5*	*25.5*	*14.8*	*6.4*	**8.4**	**5.0**
Site 52# *	*2*	*0.3*	*1.8*	*3.4*	*1.2*	*1.3*	*1.5*	*6.7*	*32.2*	*32.2*	*-*	*2.7*	**7.8**	**2.3**
*DG14**	*1.3*	*0.04*	*0.6*	*1*	*4.4*	*4.4*	*4.4*	*0.4*	*21.3*	*21.3*	*2.4*	*2.4*	**5.3**	**2.1**
Other Locations														
DG7	*3.1*	*1.5*	*0.7*	*0.6*	*0.9*	*0.4*	*0.2*	*1.2*	*1.5*	*2*	*14.5*	*4.8*	**2.6**	**2.6**
DG9	*2.6*	*3.1*	*0.7*	*1.6*	*4.7*	*2.3*	*1.7*	*1.5*	*1.2*	*1.6*	*2.5*	*4.3*	**2.3**	**2.3**
DG10^	*0.8*	*0.6*	*1.5*	*1.6*	*0.3*	*0.9*	*0.2*	*1.1*	*1.1*	*0.1*	*5.4*	*-*	**1.2**	**1.2**
I5	*5.5*	*0.4*	*1.1*	*10.3*	*0.6*	*0.1*	*0.3*	*0.2*	*1.6*	*0.9*	*14.2*	*9.6*	**3.7**	**3.7**
Lakeside	*3.2*	*3.6*	*0.8*	*6.1*	*2.6*	*0.3*	*0.6*	*0.3*	*23.8*	*2.7*	*4.6*	*7.1*	**4.6**	**4.6**
McLintock's Shed	*7.6*	*12.6*	*1.6*	*3.1*	*4.4*	*1.7*	*1.7*	*2.7*	*1.5*	*14.6*	*4.3*	*2*	**4.8**	**4.8**
Site Office	*1.7*	*0.6*	*1.3*	*0.9*	*4.8*	*1.8*	*4.8*	*2.5*	*2.8*	*2.4*	*6.6*	*4.1*	**2.9**	**2.9**
Mean	***4.2***	***1.7***	***1.2***	***2.8***	***5.3***	***2***	***6.3***	***5.6***	***16.4***	***18.4***	***12.4***	***8.9***		

* Due to high rainfall and inundation of Lake Cowal, the following dust deposition gauges could not be accessed for sampling and/or were inundated over the following time periods (yellow highlights):

- *DG2* gauge could not be accessed and/or was inundated in July and August 2016. Results averaged over this period.
- *DG3* gauge could not be accessed and/or was inundated in May and between July to November 2016. Results averaged over this period.
- *DG4* gauge could not be accessed and/or was inundated between May to July, and in September and November 2016. Results averaged over these periods.
- *DG5* gauge could not be accessed and/or was inundated between May to July and in September 2016. Results averaged over this period.
- *DG6* gauge could not be accessed and/or was inundated between September and October 2016. Results averaged over this period.
- *DG13* gauge could not be accessed and/or was inundated in September 2016. Results averaged over this period.
- *DG14* gauge could not be accessed and/or was inundated in May to June, September and November. Results averaged over this period.
- *Site 52* gauge could not be accessed and/or was inundated in September 2016. Results averaged over this period.

** Mean depositional dust calculated with inundated samples removed from the data set.

^ The dust sample from the *DG10* gauge in December 2016 was unable to be analysed as the collection vessel was destroyed during transport.

^^ The March dust samples from the *DG11* and *DG12* gauges were collected but the data is unavailable.

The *Site 52* gauge was under repair during November 2016, and so no dust data was collected for that month.

- The mean monthly deposition of insoluble solids at DG6 during the reporting period, including all months, is 5.4 g/m^2/month. If the values for September, October and November are excluded because of inundation, the mean deposition becomes 4.3 g/m^2/month. The cause of this exceedance can be attributed to two large deposits; one of 18.3 g/m^2/month in July and one of 13.1 g/m^2/month in December. The combustible fractions of these two deposits are 12% and 81%, respectively; if the very large combustible (non-mineral) fraction of the December sample is removed, the mean monthly deposition at DG6, exclusive of the inundated months, becomes 3.1 g/m^2/month and compliant with the Development Consent. The large ash (mineral) component of the July sample is substantially larger than any other dust deposit in non-inundated gauges that month, and is probably an input from muddy bird claws – there is no definitive way of demonstrating the origin of this material.
- All five of the dust gauges within ML 1535 (DG11, DG12, DG13, DG14, Site 52) recorded an annual average dust deposition above the assessment criterion. For the DG13, DG14, and Site 52 gauges, these exceedances were largely due to periods of inundation by lake water. The DG11 and DG12 gauges both received dust deposits exceeding 10 g/m^2/month in certain sampling periods. Levels recorded in the gauges inside the ML 1535 area are not relevant to the CGO Development Consent conditions.

Comparison with Environmental Impact Statement (EIS) Predictions

PEL's (2013) modelling predicted the Coniston residence (i.e. the location of the HVAS [hv1]) as the receiver with the highest predictions for 24 hour average PM_{10}, annual average PM_{10}, TSP and depositional dust. Table 11 summarises the 2016 monitoring results for 24 hour average PM_{10}, annual average PM_{10}, TSP and depositional dust and the predicted results at Coniston in comparison with the relevant Development Consent air quality impact assessment criteria 24 hour and annual average PM_{10}, TSP and depositional dust.

Table 11: Summary of Predicted PM_{10}, TSP and Dust Deposition at HV1

Emission Parameter	2016 Monitoring Results	Predicted Result at Coniston[1]	Development Consent Air Quality Impact Assessment Criteria
Maximum 24 Hour Average PM_{10}	34.4 µg/m^3	28.8 µg/m^3	50 µg/m^3
Annual Average PM_{10}	13.2 µg/m^3	3.7 µg/m^3	30 µg/m^3
TSP	33 µg/m^3	3.9 µg/m^3	90 µg/m^3
Depositional Dust	1.9 g/m^2/month	0.16 g/m^2/month	4 g/m^2/month

[1] Source: PEL (2013).

Monitoring data records from the HVAS recorded influence from local environmental factors (i.e. strong winds) and other off-site influences (i.e. dust generation from ploughing) on some dates of the 24 hour average PM_{10} monitoring results.

6.1.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.1.4 Further Improvements

The main recommendations of the University of Sydney's (2017) review are summarised below:

- Although the three-monthly duplicate samples collected in 2016 did not appear to eradicate errors in the estimated concentrations of some metals, it is nevertheless recommended that the practice of collecting these duplicate samples be continued and that the masses of these deposits be measured.
- It is further recommended that an updated set of local soil or dust source (e.g. rock crusher or tailings) samples should also be analysed for the same suite of metals as the dust samples. It is recommended that the soil/dust source samples be provided and analysed both as a 'bulk sample' of several tens of grams mass and also as a sample of comparable mass to the dust samples. This way, any dilution effects caused by small sample size should become immediately obvious, and any systematic laboratory errors (e.g. consistently high cadmium values) should also be apparent.

- A further possibility that might explain frequent metal concentration anomalies is that non-mineral (organic) components of the analysed dust samples may be more enriched in certain metals than the mineral components. It would be useful to extract the macro non-mineral fraction of the duplicate dust samples (i.e. insects, straw, large pieces of organic matter, pieces of bird excrement) and analyse these for metal concentrations separately to the mineral fractions, to assess whether this is the case.
- The efficient capture of all depositing dust remains a vexed question. Even the most efficient dust trap designs are estimated to capture only 30-40% of all depositing dust, with the majority of commonly-used traps or gauges having a collection efficiency of around 20%. A more aerodynamically efficient trap, such as the inverted frisbee trap, may have a better collection efficiency, but with the potential problem of contamination by birds being significant at a bird-breeding locality such as Lake Cowal, such efficiencies may be out-weighed by contamination. It is recommended that consideration be given to piloting the use of inverted frisbee dust traps, with anti-bird spikes affixed to the metal rims of the traps.

6.2 BLASTING

Development Consent Condition 6.3(a) details the blast impact assessment criteria relevant to the CGO. A revised Blast Management Plan (BLMP) (January 2015) was prepared for the CGO during the previous reporting period in accordance with the requirements of the Development Consent condition 6.3(e). The BLMP was approved by the DP&E on 10 December 2015.

Monitoring and management of blasting during the reporting period was undertaken in accordance with the relevant Development Consent Conditions, approved BLMP and the EPL 11912.

6.2.1 Environmental Management

In accordance with Development Consent Condition 6.3, the BLMP and EPL 11912 Conditions L5 and M7, eight blast monitors have been installed at designated locations around the CGO to record ground vibration and airblast overpressure (Figure 7). In addition, a 'control' monitor is installed at BM10, located on the eastern edge of the open pit (Figure 7).

6.2.1.1 Control Strategies

In accordance with the BLMP, the control strategies for blasting during the operation of the open pit include the following:

- Reducing the Maximum Instantaneous Charge to lowest possible level.
- Use of crushed aggregate material for stemming in blast holes to maximise confinement of the explosives in the blast hole thereby minimising the airblast effects.
- Design of drill patterns to ensure stemming heights in the blast holes are adequate to ensure confinement of the explosives.
- Delaying or postponing blast times in unfavourable weather conditions.

Additionally Evolution has adopted a practice of spacing pre-split and production blasts by one to two minutes to reduce the potential for cumulative overpressure impact on the immediate surrounds of Lake Cowal.

In accordance with Development Consent Condition 6.3, the BLMP and EPL 11912 Condition M7, airblast overpressure and ground vibration levels must be measured at nearby residences BM01, BM02, BM03 and BM08.1, at bird breeding areas BM04.1, BM05, BM09.1 and at the general monitoring site BM10.

6.2.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.2.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.2.2 Environmental Performance

6.2.2.1 Monitoring

Monitoring locations BM01 (Gumbelah), BM02 (Hillgrove), BM03 (Coniston) and BM08.1 (Cowal North) are categorised as *'residence on privately owned land'* and required to comply with the compliance limits specified in Condition 6.3 of the Development Consent (Table 12).

Table 12: Blasting Impact Assessment Criteria

Location and Time	Airblast Overpressure (dB[Lin Peak])	Ground Vibration (mm/s)	Allowable Exceedance
Residence on privately-owned land - Anytime	120	10	0%
Residence on privately-owned land - Monday to Saturday during day	115	5	5% of the total number of blasts over a period of 12 months
Residence on privately-owned land - Monday to Saturday during Evening	105	2	
Residence on privately-owned land - Monday to Saturday at Night, Sundays and Public holidays	95	1	

Notes: mm/s – millimetres per second; dB – decibel.

In addition to the compliance monitoring stations, there are four additional fixed units located within Lake Cowal (BM04.1, BM05 and BM09.1) and on the eastern edge of the open pit (BM10).

Ground vibration and air overpressure monitoring was conducted with the use of Instantel Series III blast monitors. Eight units were located at fixed monitoring stations in accordance with the BLMP.

All blast monitoring equipment underwent an annual calibration, in accordance with Australian Standard specifications. Additional to the monitor and sensor calibrations, all batteries were replaced and routine maintenance was carried out on all units.

During the reporting period there were incidences where units were offline for more than 24 hours. These incidences are listed below:

- BM04.1 was offline from 11 May to 4 July 2016 due to equipment faults.
- BM10 was offline from 20 January to 31 January 2016 and 13 September to 2 November 2016 due to equipment faults.
- BM05 was offline from 13 February to the 20 February 2016, 13 March 2016 and from 6 August to 18 September 2016 due to equipment faults.
- BM09.1 was offline on 9 September and 21 September 2016 due to equipment faults.
- BM04.1, BM05 and BM09.1 were damaged due to rising water levels in Lake Cowal during the October period.
- BM04.1, BM05 and BM09.1 were decommissioned in February 2017 in accordance with the variation of EPL 11912.

No blast monitoring locations used to assess compliance (i.e. BM01, BM02, BM03 and BM08.1) were offline for more than 24 hours during the reporting period.

6.2.2.2 Performance Outcomes

Ground Vibration

A total of 168 blasts were fired during the reporting period. Based on the monitoring data and blasting information available, recorded levels of ground vibration induced by blasting activities conducted at the CGO were compliant with respect to the ground vibration compliance limits.

The maximum vibration level recorded on a compliance monitor at a blast time was 0.41 mm/s recorded at BM08.1 – Cowal North residence on 13 October 2016. This result is significantly lower than compliance limits.

Air Overpressure

A detailed examination of the monitoring data and blasting information was undertaken to ascertain the peak overpressure levels recorded around the time of the specified blasts. A total of 10 events (Table 13) were identified as having a peak overpressure level exceeding the compliance criteria. The data was then analysed to determine whether the cause was blast related or related to localised environmental factors.

Table 13: Blasting Impact Exceedences

Monitoring Location	Date	Time	PPV (mm/s)	Overpressure dB(L)	Compliance Limit	Comments
BM02 – Hillgrove Residence	31/01/2016	12:35:30	0.10	95.9	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely
BM08.1 – Cowal North	31/01/2016	12:35:30	0.07	97.5	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely
BM02 – Hillgrove Residence	13/03/2016	12:39:00	0.11	95.6	95dB(L) – Sundays and Public Holidays	Likely blast related
BM01 – Gumbelah Residence	26/03/2016	12:35:05	0.09	95.9	95dB(L) – Sundays and Public Holidays	Likely blast related
BM01 – Gumbelah Residence	3/04/2016	13:35:00	0.10	100.0	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely
BM01 – Gumbelah Residence	24/06/2016	12:33:00	0.12	115.9	115.0dB(L) – daytime compliance limit	Not blast related, localised environmental factors likely
BM02 – Hillgrove Residence	20/11/2016	12:25:19	0.12	97.5	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely
BM01 – Gumbelah Residence	4/12/2016	12:30:51	0.11	100.0	95dB(L) – Sundays and Public Holidays	Likely blast related
BM02 – Hillgrove Residence	18/12/2016	12:26:24	0.12	95.9	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely
BM02 – Hillgrove Residence	26/12/2016	12:47:11	0.11	106.5	95dB(L) – Sundays and Public Holidays	Not blast related, localised environmental factors likely

Notes: PPV – peak particle velocity.

Of the 10 events that exceeded compliance levels, three of these were assessed to be related to blasting practices, with the other seven of these identified as localised environmental factors such as wind. This has been identified by the extended durations of high overpressure readings within the 30 minute histogram blast window. The majority of exceedances identified at blast times were related to the Sundays' and Public Holidays' compliance limit of 95 dB(L).

One exceedance was related to the normal weekday and Saturday limit of 115 dB(L). This is to be anticipated given the Sundays' and Public Holiday's overpressure level of 95 dB(L) is a significant reduction to the normal weekday and Saturday limit of 115 dB(L). It is important to note that this 20 dB(L) reduction is equivalent to reducing the weekday and Saturday limit by 90% for Sunday and Public Holiday blasting.

Out of a total of 168 blasts:

- No blast related events exceeded the maximum compliance level of 120 dB(L).
- No blast related events exceeded the 115 dB(L) level on normal weekdays and Saturdays.
- A total of three blast related events or 1.79% of the total blasts exceeded the 95 dB(L) level on Sundays and Public Holidays.

Comparison of Blast Monitoring Results with Previous Years Results and EIS Predictions

Blasting monitoring results during the reporting period are consistent with previous years and with the predictions detailed in the *Cowal Gold Mine Extension Modification Environmental Assessment* (Barrick, 2013) in that there was:

- no exceedance of the airblast overpressure level of 120 dB(L) or ground vibration level of 10 mm/s at any residence on privately-owned land at anytime; and
- not more than 5% of the total number of blasts at any residence on privately-owned land exceeding the airblast overpressure levels or ground vibration levels Monday to Saturday during the day, evening, night or on Sundays and public holidays.

6.2.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.2.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.3 OPERATIONAL NOISE

Development Consent Condition 6.4(c) details the noise impact assessment criteria relevant to CGO. A revised Noise Management Plan (NMP) was prepared for the CGO during the previous reporting period in accordance with the requirements of the Development Consent condition 6.4(e). The NMP was approved by the DP&E on the 5 March 2015.

Monitoring and management of noise during the reporting period was undertaken in accordance with the relevant Development Consent conditions, approved NMP and the EPL 11912.

6.3.1 Environmental Management

6.3.1.1 Control Strategies

In accordance with the NMP, control strategies used at the CGO during the reporting period utilised best management practices and the best available technology economically achievable.

Best Management Practice

Best management practices applied during the reporting period to minimise CGO noise emissions included:

- Restricting movement of trucks on ridgelines and exposed haul routes where their noise can propagate over a wide area, especially at night. This means restricting night-time movement of material to areas shielded by barriers or mounds, and reserving large-scale material movement for daytime. The Lake Protection Bund provides noise shielding, thereby reducing noise levels that could propagate from the open pit across Lake Cowal.

- Scheduling the use of any noisy equipment during daytime.
- Locating noisy equipment behind structures that act as barriers, or at the greatest distance from any noise-sensitive areas, or orienting the equipment so that noise emissions are directed away from any sensitive areas, to achieve the maximum attenuation of noise.
- Where there are several noisy pieces of equipment, scheduling operations so they are used separately rather than concurrently.
- Keeping equipment well maintained.
- Employing 'quiet' practices when operating equipment (i.e. positioning idling trucks in appropriate areas).
- Educating staff on the effects of noise and the use of quiet work practices.
- Specify maximum noise/sound levels when purchasing equipment.
- Including maximum noise/sound levels in tender documents and contracts.

Best Available Technology Economically Achievable

Best available technology economically achievable applied during the reporting period to minimise CGO noise emissions included:

- adjusting reversing alarms on heavy equipment limiting acoustic range to the immediate danger area;
- minimising night time tracking of dozers on top of stockpiles;
- restricting working hours on faces closest to neighbours during wall lift project works;
- using equipment with efficient mufflers;
- damping or lining metal trays on Dump Trucks; and/or
- employing active noise control measures during normal and maintenance shutdown periods.

6.3.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.3.1.3 Variations from Proposed Strategies

There were no variations from the proposed control strategies during the reporting period.

6.3.2 Environmental Performance

6.3.2.1 Monitoring

Noise monitoring was undertaken during the reporting period to demonstrate compliance with the noise impact assessment criteria set out in Development Consent Condition 6.4(c), which requires that noise generated by the CGO does not exceed the criteria in Table 14 below, at any residence on privately-owned land. The noise impact criteria outlined in Table 14 was subsequently revised following this reporting period, however the criteria relevant during the reporting period are provided in the table.

Table 14: Noise Impact Assessment Criteria dB(A) $L_{Aeq\ (15minute)}$

Location (Figure 7)	Day/Evening/Night
Laurel Park	37
Bramboyne, Bungabulla, The Glen and Gumbelah	36
All other privately-owned land	35

Evolution has entered into noise mitigation agreements with owners of the Laurel Park, Gumbelah and Cowal North properties.

Spectrum Acoustics conducted mine operational noise monitoring at quarterly intervals throughout the reporting period in accordance with the NMP. Table 15 provides a summary of the quarterly attended noise monitoring results for the Laurel Park, Bramboyne, Bungabulla, The Glen and Gumbelah properties recorded during the reporting period (Spectrum Acoustics, 2016a, 2016b, 2016c, 2016d).

Table 15: Summary of Attended Noise Monitoring Results

Property	January 2016	April 2016	July 2016	November 2016
Laurel Park	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - 21, 21	E - <20, <20	E - 23, 23
	N - <20, <20	N - 26, 24	N - <20, <20	N - <20, <20
Bramboyne	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - 20, 20	E - <20, <20	E - <20, <20
	N - <20, <20	N - 25, 22	N - <20, <20	N - <20, <20
Bungabulla	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - 20, <20	E - <20, <20	E - <20, <20
	N - <20, <20	N - <20, <20	N – 22, 24	N - <20, <20
The Glen	D - <20, <20	D - <20, <20	D - <20, <20	D – 22, 22
	E - <20, <20	E - 23, 24	E - <20, <20	E - <20, <20
	N - <20, <20	N - 23, 22	N - <20, <20	N - <20, <20
Gumbelah	D - <20, <20	D - <20, <20	D - <20, <20	D - <20, <20
	E - <20, <20	E - 21, <20	E - <20, <20	E - <20, <20
	N - <20, <20	N - 22, 20	N - <20, <20	N - <20, <20

Source: Spectrum Acoustics (2016a, b, c, d).

Notes: D = day; E = evening; N = night.

6.3.2.2 Performance Outcomes

Attended noise monitoring results for the Laurel Park, Bramboyne, Bungabulla, The Glen and Gumbelah properties are well below the noise impact assessment criteria for these properties defined in Development Consent Condition 6.4(c).

Comparison with EIS Predictions

Table 16 summarises SLR Consulting Australia's (SLR's) (2013) predicted $L_{Aeq(15\ minute)}$ noise levels at the nearest privately-owned residential receivers (excluding those properties already afforded acquisition rights [i.e. Coniston, Westlea and Westella]) during day, evening and night-time periods during a strong inversion, in comparison to the noise impact assessment criteria for these properties listed in Development Consent Condition 6.4(c).

Table 16: Summary of Predicted Intrusive $L_{Aeq(15\ minute)}$ Noise Levels at Nearest Privately-owned Residential Receivers

Privately-owned Residential Receiver	Predicted Noise Level $L_{Aeq(15\ minute)}$ Day/Evening/Night-time during Strong Inversion (1800 – 0700 hours)	Noise Impact Assessment Criteria defined in Development Consent Condition 6.4(c)
Laurel Park	37	37
Bramboyne	36	36
Bungabulla	35	36
The Glen	36	36
Gumbelah	35	36

Source: SLR (2013).

6.3.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.3.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.4 VISUAL, STRAY LIGHT

Development Consent Condition 6.5(b) details the requirements for management of visual and off-site lighting impacts from CGO.

Monitoring and management of visual and off-site lighting impacts during the reporting period was undertaken in accordance with the relevant Development Consent conditions.

6.4.1 Environmental Management

6.4.1.1 Control Strategies

In accordance with Development Consent Condition 6.5(b), visual impact mitigation measures that have been employed at the CGO during the reporting period included landscaping and design specifically conducted for visual impact mitigation purposes. Specific landscaping strategies included:

- utilising existing vegetation as visual screens;
- planting of vegetation screens around the ML 1535 boundary;
- construction of the waste emplacements, reducing visual impact of the processing plant from the eastern side of Lake Cowal;
- placement of topsoil stockpiles on the southern and western sides of the STSF to break the view from the relocated Travelling Stock Route;
- outdoor lighting set-up in accordance with *AS 4282-1997 Control of the obtrusive effects of outdoor lighting*; and
- selecting the colour of the processing plant buildings to blend with the adjacent landscape in accordance with the requirements of Bland Shire Council (BSC).

6.4.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.4.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.4.2 Environmental Performance

6.4.2.1 Monitoring

A summary of the maintenance and monitoring programme implemented during the reporting period is provided in Table 17.

Table 17: Landscape Maintenance and Monitoring Summary

Component	Monitoring Frequency	Monitoring Method	Typical Maintenance
Landscaping Works			
• General Inspections	Annual	Visual assessment of moisture stress, plant survival, presence of weeds and erosion/ sedimentation.	• Supplementary watering if required. • Control of invasive weed species. • Supplementary planting of failed plants where necessary.
• Erosion Inspections	Following significant, high intensity rainfall events.	Visual assessment of earth mound screening to determine if significant erosion or washouts have occurred in accordance with the ESCMP.	• Repair any significant erosion or washout areas on earth mounds. • Stabilisation with Jute mesh or other materials as required. • Additional revegetation planting or sowing if required.
Buildings, Structures and Facilities	Annual	Visual assessment by a suitably qualified building inspector.	• Replace or repair items as necessary to maintain structural integrity. • Repaint any exterior surfaces where the finish has deteriorated. • Maintain fixed outdoor and in-pit mobile lighting.
Rehabilitation Works			
• General Inspections	Annual	Monitoring in accordance with the Rehabilitation and Offset Management Plan (ROMP) and MOP (with reporting in the AR).	• Repair any significant erosion or washout areas. • Control of invasive weed species in accordance with the LMP. • Supplementary planting or seeding of failed plants where necessary.
• Erosion Inspections	Following significant, high intensity rainfall events.	Visual assessment of rehabilitation works to determine if significant erosion or washouts have occurred in accordance with the ESCMP.	• Repair any significant erosion or washout areas on earth mounds. • Stabilisation with Jute mesh or other materials as required. • Additional revegetation planting or sowing if required.

6.4.2.2 Performance Outcomes

Visual impact management and landscape maintenance and monitoring measures conducted during the reporting period included:

- inspections and maintenance of fixed outdoor lighting and in-pit mobile lighting;
- general inspections of landscaping (i.e. visual screens) and rehabilitation works;
- monitoring of tree and shrub survival rates of landscape plantings; and
- erosion inspections of landscaping and rehabilitation works following periods of significant, high intensity rainfall.

As a result of this visual landscape monitoring the following maintenance activities were undertaken:

- weed control within landscaping and rehabilitation areas by manual removal or chemical application; and
- maintenance of erosion control structures.

6.4.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.4.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.5 EROSION AND SEDIMENT

Development Consent Condition 3.5(a) provides erosion and sediment control strategies for works to be undertaken throughout the life of the CGO (i.e. construction and operations).

Evolution prepared and submitted for approval an Addendum to the ESCMP during the reporting period to incorporate the components of the approved CGO relevant to the ESCMP (i.e. the new D10 contained water storage, the modified design of contained water storage D5 and to include new soil stockpiles). The ESCMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of erosion and sediment control during the reporting period was undertaken in accordance with the relevant Development Consent Conditions, relevant ML 1535 conditions, the approved ESCMP and EPL 11912.

6.5.1 Environmental Management

6.5.1.1 Control Strategies

A summary of the control strategies/management measures implemented during the reporting period in accordance with the ESCMP is provided in Table 18.

Table 18: Summary of Erosion and Sediment Control Strategies/ Management Measures

Project Development	Control Strategy/Management Measure
Temporary Erosion and Sediment Controls Systems	
Internal Mine Access Road	• Minimisation of disturbance to watercourses that cross the road. • Provision of culverts and diversion of runoff from undisturbed areas. • Erection of sediment control barrier downslope of small, disturbed areas. • Provision of sediment basins for concentrated runoff areas. • Stabilisation of the access road surface. • Rapid stabilisation and revegetation of road batters.
ML 1535 Fences	• Minimising the area disturbed and restricting access to non-disturbed areas.
Ore Stockpile and Process Plant Area	• Minimising the area disturbed and restricting access to non-disturbed areas. • Settlement/plant runoff storage. • Installation of sediment control barrier. • Installation of runoff collections drains. • Dewatering of settlement storage following rainfall events. • Ripping and rehabilitation of hardstand areas.
Soil Stockpiles	• Use of sediment control barrier and sediment traps to minimise soil movement. • Use of diversion banks, channels and rip-rap structures to divert surface water around disturbed areas and control runoff velocity.
Internal Mine Roads	• Constructing all access roads at an appropriated slope along the contour, where practicable. • The use of spoon drains, table drains and concrete culverts to control surface runoff from access roads. • Ripping and rehabilitation of roads no longer required for access.

Table 18 (Continued): Summary of Erosion and Sediment Control Strategies/ Management Measures

Project Development	Control Strategy/Management Measure
Contractors' Area	• Minimising the area disturbed and restricting access to non-disturbed areas. • Erection of sediment control barrier downslope of small, disturbed areas. • Provision of sediment basins for concentrated runoff areas. • Ripping and rehabilitation of hardstand areas.
Earthworks Associated with Landscaping	• Use of sediment control barriers and sediment traps to minimise soil movement.
Internal Catchment Drainage System (ICDS)	• Construction of the ICDS as described in the ESCMP. • Construction of sediment retention storages to reduce non-colloidal fraction of sediment carried in runoff from large disturbed areas. Storages sized to provide flow detention and effective settlement during small to medium sized flood events (1 in 20 year 1 hour event). • Use of small-scale runoff controls comprising hay bales and rockfill bunds to control sediment loads in runoff from small areas. Silt control hay bale weirs installed downslope of all disturbed areas. • Rapid stabilisation of disturbed areas using contour banks and furrows, erosion-stable drainage paths and early revegetation or armouring of disturbed areas. Disturbed areas rapidly stabilised to reduce sediment fluxes.
Permanent Erosion and Sediment Controls Systems	
Lake Isolation System	• Construction of the Temporary Isolation Bund and Lake Protection Bund as described in the ESCMP. • Stabilisation and revegetation of the batters of the Temporary Isolation Bund and Lake Protection Bund.
Up-Catchment Diversion System (UCDS)	• Construction of the UCDS as described in the ESCMP to divert upper catchment water around the CGO. • Installation of rip-rap structures along UCDS and rock outfalls at confluences with existing natural drainage lines. • Vegetation stabilisation.
Earth Mounds (associated with the ICDS)	• Vegetative stabilization.
Monitoring and Maintenance	• Water quality monitoring in accordance with the Surface Water, Groundwater, Meteorological and Biological Monitoring Programme (SWGMBMP). • Maintenance of erosion and sediment control structure where necessary.

6.5.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.5.1.3 Variations from Proposed Control Strategies

There were no variations to the proposed control strategies during the reporting period.

6.5.2 Environmental Performance

6.5.2.1 Monitoring

In accordance with the ESCMP, inspections and maintenance of erosion and sediment control structures (e.g. silt fences, hay-bales, sediment ponds and diversion structures) occurred as required during the reporting period.

The ESCMP also requires the following to be reported in the AR:

- Surface and groundwater monitoring results.
- Comparison of surface water and groundwater monitoring results with criteria in the SWGMBMP.
- Interpretation and discussion of the surface and groundwater monitoring programme results.
- Community Environmental Monitoring & Consultative Community (CEMCC) decisions relating to CGO ESCMP issues.

6.5.2.2 Performance Outcomes

The CGO geotechnical department conducted monthly monitoring and assessment of structures such as all water holding facilities on site, waste emplacements and the lake protection bund for sediment movement and erosion control effectiveness in accordance with the CGO's *Monitoring Programme for the Detection of Movement of the Lake Protection Bund, Water Storage and Tailings Structures and Pit/Void Walls*. The monthly monitoring and assessments indicated no significant sediment movement or erosion incidence of the contained water storages, waste rock emplacements, lake protection bund and temporary isolation bund.

The progressive rehabilitation for final landform slopes continues to demonstrate effective erosion control as evidenced by independent specialists DnA Environmental (DnA Environmental, 2016a).

6.5.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.5.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.6 CYANIDE MANAGEMENT

Development Consent Condition 5.3 outlines requirements in relation to the management of cyanide at the CGO. A cyanide monitoring programme has been developed for CGO and is incorporated into the CGO's Cyanide Management Plan (CMP), which has been prepared in accordance with Development Consent Condition 5.3(b).

The EPL 11912 requires Evolution to undertake cyanide monitoring at the points identified in EPL 11912 Condition P1.3. The cyanide monitoring points and frequencies required by the EPL 11912 are consistent with monitoring required by the Development Consent and the CMP. The CMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of cyanide during the reporting period was undertaken in accordance with the relevant Development Consent Conditions, the approved CMP and EPL 11912.

Evolution has continued to report monthly weak acid dissociable cyanide (CN_{WAD}) results on the company's website during the reporting period. Evolution also reported and discussed these results with the CEMCC at all quarterly meetings.

6.6.1 Environmental Management

6.6.1.1 Control Strategies

A summary of the control strategies maintained during the reporting period in accordance with the CMP is provided below:

- Containment of all tailings waters within the TSFs, processing plant and processing plant dams. Maintenance of the Lake Protection Bund and upper catchment diversion drain systems.
- Provision of emergency containment channels alongside tailings storage pipelines to and from the TSFs. Maintenance of process pipe work, equipment and leak detection equipment.
- Terrestrial fauna protection fencing and avifauna deterrent methods to minimise the potential for impacts of tailings operations.
- Use of sodium metabisulphite to destruct cyanide in tailings slurry to permissible levels before the processing plant slurry discharge is pumped to the TSFs (with standby Caro's Acid circuit).
- Routine monitoring and reporting of tailings facility flows, ground and surface waters, and employee work areas for cyanide levels.
- Maintenance of emergency preparedness of employees and supply chain in reporting and response capability.
- Routine patrols of tailings and process areas to ensure the potential for spillage, dust or native fauna and flora impacts are minimised.

The CGO is certified under the International Cyanide Management Institute's (ICMI) Code for Cyanide Management. Details regarding the re-certification audit are provided on the ICMI's website: http://www.cyanidecode.org/signatory-company-categories/evolution-mining-cowal-pty-ltd-australia

6.6.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.6.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.6.2 Environmental Performance

6.6.2.1 Monitoring

In accordance with the CMP and Development Consent Condition 5.3(d), results of CN_{WAD} monitoring of tailings discharge (at the processing plant) and decant water were monitored during the reporting period. Levels of CN_{WAD} recorded are presented in Table 19.

6.6.2.2 Performance Outcomes

In accordance with Consent Condition 5.3(d)(i), CN_{WAD} levels of the aqueous component of the tailings slurry stream were maintained so that they do not exceed 20 milligrams (mg) CN_{WAD}/L (90 percentile over six months) and 30 mg CN_{WAD}/L (maximum permissible limit at any time) at the process plant during the reporting period. Monitoring results have remained low and within licence conditions.

All groundwater results for cyanide during the reporting period remained below the laboratory detection limit.

Table 19 : CN_{WAD} Levels of the Aqueous Component of the Tailings Slurry

			CN_{WAD} (mg/L)	
Frequency	**Month**	**No. Sampled during Month**	**Minimum**	**Maximum**
Twice daily	January	57	0.7	13.1
Twice daily	February	57	0.1	11.3
Twice daily	March	62	1.8	12.0
Twice daily	April	47	0.2	25.2
Twice daily	May	62	0.6	13.5
Twice daily	June	58	0.5	12.3
Twice daily	July	62	1.5	14.9
Twice daily	August	55	0.2	15.3
Twice daily	September	53	0.6	13.3
Twice daily	October	62	0.2	14.7
Twice daily	November	60	0.4	15.7
Twice daily	December	57	2.3	10.9

6.6.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.6.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.7 FLORA

Development Consent Condition 3.2 details the requirements for the CGO in relation to the management of flora and fauna. A FFMP and Threatened Species Management Protocol (TSMP) have been developed for the CGO in accordance with Development Consent Conditions 3.2(b) and 3.2(c), respectively. The FFMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of flora continued in accordance with the requirements of the FFMP, the TSMP, the BOMP and the ROMP during the reporting period.

6.7.1 Environmental Management

6.7.1.1 Control Strategies

Flora control strategies for the CGO are described in the FFMP. The following control strategies were implemented at the CGO during the reporting period:

- implementation of Compensatory Wetland Management Plan (CWMP) initiatives and the Remnant Vegetation Enhancement Program (RVEP);
- incorporation of flora management initiatives during operational design;
- implementation of the Vegetation Clearance Protocol (VCP);
- implementation of the TSMP;
- weed management and pest control;
- flora monitoring programme;

- observance of the Threatened Species Management Strategies (TSMSs) for the relevant Endangered Ecological Communities:
  - Inland Grey Box Woodland – approved 31 August 2007;
  - Myall Woodland – approved 24 September 2007; and
  - Aquatic Ecosystems (lower Lachlan River) – approved 12 October 2007;
- provision of information relevant to the management of native flora during employee and contractor inductions;
- development and submission of a RMP (including mine site rehabilitation performance and completion criteria and a mine site rehabilitation monitoring programme relevant to the approved CGO); and
- development and submission of a BOMP (including an offset performance and completion criteria and an offset monitoring programme relevant to the approved CGO offset areas).

6.7.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.7.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.7.2 Environmental Performance

6.7.2.1 Monitoring

Monitoring and management of flora continued in accordance with the requirements of the FFMP (Section 6.7.1.1), the BOMP and the ROMP during the reporting period.

Flora monitoring was conducted during the reporting period in accordance with the ROMP, including within the following areas:

- Compensatory Wetland (CW);
- rehabilitation areas and rehabilitation trial areas;
- offset management areas;
- *Pilularia novae-hollandiae* (Austral Pillwort) habitat; and
- RVEP areas (Figure 5).

6.7.2.2 Performance Outcomes

Flora monitoring within the CW and RVEP areas was undertaken by DnA Environmental (2017b) during the reporting period. A summary of the results from this monitoring survey are outlined below.

Compensatory Wetland

During the reporting period there had been extensive flooding over the winter months, resulting in water flooding the temporary bund. As most of the monitoring sites were under water, they were not monitored during the reporting period. It was noted however, that the *Muehlenbeckia florulenta*, *Eucalyptus camaldulensis* and *Acacia stenophylla* saplings had significantly grown. The flood waters have caused the ground covers to die off in CWT2, while in CWT3 wave action has caused erosion of the topsoil and associated vegetation to expose an underlying rocky substrate.

Pilularia novae-hollandiae (Austral Pillwort) Habitat

During the reporting period seasonal conditions were good with the water in most gilgais having recently receded, with most being heavily vegetated with wetland species. While some of the larger and deeper gilgais may have retained water, some recently receded gilgais contained areas with exposed grey clay soil with little vegetation establishment. While these are known to be preferred habitats of the *Pilularia novae-hollandiae* (Austral Pillwort), none were located despite expanding the search areas and conducting extensive search efforts (DnA Environmental, 2017c).

Remnant Vegetation Enhancement Program (RVEP)

Four RVEP sites were assessed in 2016 and these were RVEPHill01, RVEPHill02, RVEPHill03 and RVEPHill04 (located within RVEP Area 1). RVEP3 and RVEP4 were not accessible due to inundation during the reporting period. The monitoring of the RVEP sites have been a simplified version of the annual rehabilitation monitoring program and did not include Landscape Function Analyses or soil analyses but has been consistent since 2008.

Since RVEP1 has been excluded from grazing by domestic livestock, there has been an increasing number of macropods using this site, in particular a growing population of Eastern Grey Kangaroos. Due to the potentially high grazing pressure, four Kangaroo-proof enclosures were constructed in 2008 and monitoring sites were also established within these to assess the impact of the macropod grazing, if any, on the health and diversity of the remnant vegetation. In addition, approximately 200 Eastern Grey kangaroos were tagged and culled during the reporting period on Felman's Hill area (RVEP1).

In total, there have been 10 permanent monitoring quadrats established within the RVEP Areas 1, 3 and 4. In six of the enclosure sites, the survey quadrats are 50 m x 20 m and are surveyed annually to monitor changes in vegetation cover, species diversity and to determine the extent of regeneration occurring within these conservation sites. In the remaining four enclosure sites in RVEP1 (Fellman's Hill), the size of the monitoring quadrats was reduced to a 20 m x 20m quadrat to fit within the enclosures.

There has been no consistent trend in changes in total ground cover since 2008 but typically most sites have demonstrated an overall improvement since then. A slight decrease was recorded in 2014 due to the prolonged dry conditions and/or increased grazing intensity, however all sites maintained high total ground cover levels with slightly improved ground cover being recorded in most sites during this reporting period.

Like last year, this year saw improved seasonal conditions resulting in a significant increase in floristic diversity in all monitoring sites with the highest diversity of species recorded in Hill04 with 57 species, followed by RVEPHill02 with 48 species. These sites were situated on the fringing *E. dwyeri* woodland – cleared native grasslands.

No threatened flora has been recorded in the range of RVEP monitoring sites in any monitoring year. This year there were two *Lycium ferocissimum* (African Boxthorn) seedlings recorded in RVEPHill04. *Phyla canescens* (Lippia), is a Class 4 noxious weed in NSW and was recorded in low densities in site RVEP4 and recorded in increasing numbers and distribution on the edges of Lake Cowal, especially in areas which have been recently inundated.

The exclusion of livestock grazing as a result of the RVEP has had a significant effect on the recovery of the degraded woodlands and native grasslands with their condition, diversity and function also responding to climatic and biophysical factors. While these have been quite extreme since monitoring began it appears that increasing numbers of macropods on Fellman's Hill have been having a negative impact on the recovery of the woodlands and may require management intervention to reduce and maintain these populations to sustainable levels. In addition cattle continue to graze RVEP3 and RVEP4 conservation areas as the fences and gates are extensively damaged and require repair.

Vegetation Clearance

There were no vegetation clearance activities conducted during the reporting period.

6.7.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.7.4 Further Improvements

Fencing at the RVEP3 and RVEP4 monitoring sites has been budgeted and was planned for during the reporting period, however due to high rainfall the sites were inaccessible. The project is planned for the next reporting period.

6.8 BIODIVERSITY OFFSET AREAS

Development Consent Condition 3.4 details the requirements for the CGO in relation to the biodiversity offset strategy. A BOMP has been developed for the CGO in accordance with Development Consent Condition 3.4(c). The BOMP has also been prepared to reflect the approved biodiversity offset strategy described in the *Cowal Gold Mine Extension Modification Environmental Assessment* (Barrick, 2013). The BOMP was approved on 10 September 2015.

Monitoring and management of the offset management areas continued in accordance with the requirements of the BOMP during the reporting period.

6.8.1 Environmental Management

6.8.1.1 Control Strategies

The Biodiversity Offset Strategy is described in the BOMP and includes:

- a description of the offset;
- objectives for the offset;
- short, medium and long-term management measures and performance criteria;
- a description of how the strategy integrates with the CGO's rehabilitation programme;
- a monitoring programme;
- revegetation and regeneration performance indicators and completion criteria;
- details for the long-term protection mechanism for the offset areas; and
- the conservation bond requirements relevant to implementation of the biodiversity offset strategy.

The following control strategies were implemented at the CGO during the reporting period:

- Progression in securing the tenure of the offset areas and calculating the required bond, to the satisfaction of the Secretary.
- Weed management and pest control.
- Offset monitoring programme.

6.8.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.8.1.3 Variations from Proposed Control Strategies

Evolution completed a cull of Eastern Grey Kangaroos within the Felman's Hill area, as the population became unsustainable (Section 6.7.2.2). The CGO applied for 200 drop tags from the Griffith NSW National Parks & Wildlife Services prior to conducting the cull. The cull was conducted during the reporting period in November/December 2016.

6.8.2 Environmental Performance

As required by Development Consent Condition 3.4(b), Evolution is required to enter into a Voluntary Planning Agreement (VPA) with the NSW Minister for Planning to secure tenure over 440 hectares (ha) of land to the north and south of ML 1535 as a biodiversity offset for the CGO. During the reporting period, a number of edits suggested by the DP&E and Evolution's legal advisors were incorporated into the VPA and bank guarantee and provided back to Evolution for finalisation. A further extension until 30 June 2017 for the execution of the VPA was requested on 23 June 2016 and subsequently granted by the DP&E on 30 June 2016. The previously accepted conservation bond value did not change during the reporting period. This bank guarantee will be provided once the VPA is executed.

6.8.2.1 Monitoring

Monitoring and management of the offset management areas continued in accordance with the requirements of the BOMP during the reporting period.

6.8.2.2 Performance Outcomes

Monitoring within the Biodiversity Offset Areas was undertaken by DnA Environmental (2017b) during the reporting period. A summary of the results from this monitoring survey are outlined below:

Northern Offset

Both of the Northern offset monitoring areas (NOAs) have typically demonstrated an increasing trend in ecological function as grazing pressure has been minimal, promoting an increase in perennial plant and litter covers and litter decomposition. This has resulted in a reduction in soil surface crusting and surface hardness. Both NOA sites continue to be more functional than their comparative reference sites despite the lack of trees or shrubs. In all sites the soils were typically very hard and slightly unstable, however, these characteristics appear to be typical of these lower slope communities.

Species diversity in the NOA sites followed a similar trend to the reference sites with changes strongly correlated with the changing seasonal conditions however both NOA sites had a reduction in diversity this year, but site NOA01 continued to be more diverse than the slope reference sites. While there was an adequate representation of native species in NOA01 there was a low diversity in NOA02. Both NOA sites continued to have a higher diversity of exotics species than desired. This year good winter rainfall has resulted in a flush of annual exotic plants, but most of these were dead at the time of monitoring. There was quite a significant increase in native plant abundance in NOA01, native plants continued to provide the most ground cover and was similar to the reference sites. Site NOA02 had a much lower native plant cover with the site being weedier than desired.

The soil chemistry was highly variable within and between sites with the results of the soil analyses indicating the soils in the lower slopes and gilgais environments around Lake Cowal can be "naturally" saline, slightly alkaline and potentially sodic. The data indicated the soils were typically deficient in OM, P and N but these also were typical of these lowland woodlands. The results also indicate that there were elevated levels of calcium (Ca), magnesium (Mg) and potassium (K) in the NOA sites. These elements were also recorded in elevated levels within the reference sites suggesting that these elements can occur at naturally higher levels within the lake and floodplain environments around Lake Cowal. In the slope reference sites, there were up to 11 times higher concentrations of Ca than the recommended levels, while there were seven times higher concentrations of Mg. In RSlope02, there were also moderately high concentrations of sulfur.

Southern Offset

The Southern Offset Areas (SOAs) were old cropping paddocks and have become ecologically very stable due to the relatively high levels of litter which were largely derived from dead annual plants. During the reporting period, site SOA02 was sprayed into approximately 1m wide strips and planted with tubestock however this had little effect on the functional capacity of the site. Cryptogams remained common and the soils were very hard and crusted with little evidence of erosion and deposition. While there continued to be low perennial vegetation cover, there was an increased cover of litter and cryptogam covers in SOA01 and SOA02 this year. Compared to the reference sites both SOA sites had a comparable stability, infiltration and nutrient capacity, despite the lack of a mature overstorey and scattered shrub understory. The three new SOA sites established on the eastern side of Fellman's Hill also had a similar functional capacity but they may have had a slightly lower infiltration (DnA Environmental, 2017b).

In terms of meeting completion targets there was an obvious lack of tree and shrub species and associated structure and habitat requirements. In SOA02 there was an appropriate diversity and density of native trees and shrubs as a result of the recent planting project. The proposed revegetation activities of these sites should show an improvement in these key performance indicators providing appropriate species and densities are implemented. As the completion criteria have been derived from the adjacent ridge and hill communities, revegetation activities should aim to replicate these community types.

6.8.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.8.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.9 FAUNA

As outlined in Section 6.7, Development Consent Condition 3.2 details the requirements for the CGO in relation to the management of flora and fauna. A FFMP and TSMP have been developed for the CGO in accordance with Development Consent Conditions 3.2(b) and 3.2(c), respectively. The FFMP has also been prepared to address the relevant requirements of ML 1535.

Monitoring and management of fauna continued in accordance with the requirements of the FFMP, the TSMP, the BOMP and the ROMP during the reporting period.

In accordance with the TSMP, TSMSs were prepared for the following fauna species:

- Inland Forest Bat.
- Sloane's Froglet.
- Woodland birds including the Little Eagle, Spotted Harrier, Square-tailed Kite, Varied Sitella and White-fronted Chat.

Evolution has not received formal approval of the TSMSs however, verbal advice was received from the DP&E (Kane Winward) on 26 September 2013 advising that Evolution can implement the EMPs and strategies (including the TSMSs) at the CGO which were pending formal approval by the DP&E.

6.9.1 Environmental Management

6.9.1.1 Control Strategies

The relevant control strategies for the management of fauna species are described in the FFMP, ROMP and BOMP and include:

- implementation of CWMP initiatives and the RVEP;
- incorporation of fauna management initiatives during operational design;
- implementation of the VCP (including pre-clearance surveys);
- implementation of the TSMP;
- implementation of the Plan to Protect Fauna from Interactions with the TSFs;
- management of impacts on terrestrial and aquatic fauna;
- rehabilitation of disturbance areas;
- weed management and pest control (discussed in Section 6.10);
- fauna monitoring program;

- maintaining a clean, rubbish free environment to discourage scavenging;
- prohibition for the introduction of animals including domestic pets on ML 1535;
- imposing speed limits within ML 1535 to reduce the risk of fauna mortality via vehicular strike; and
- provision of information relevant to the management of native fauna during employee and contractor inductions.

6.9.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.9.1.3 Variations from proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.9.2 Environmental Performance

6.9.2.1 Monitoring

In accordance with the FFMP, monitoring activities in relation to fauna were conducted during the reporting period, including:

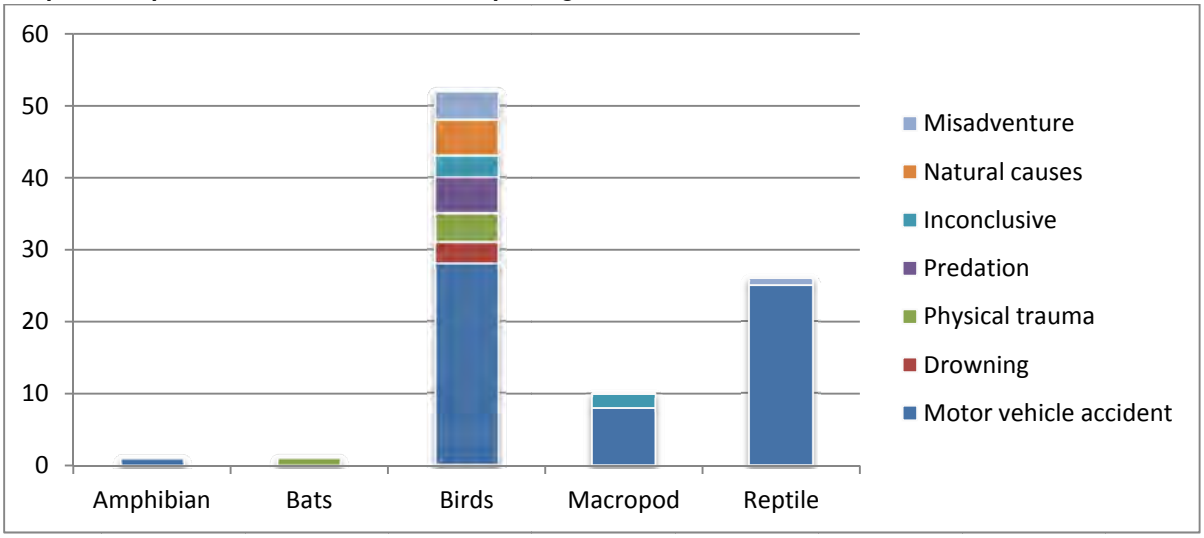
- continuation of long-term monitoring of bird breeding;
- bat call monitoring at the active TSF and control site;
- twice daily monitoring of any fauna usage of the TSFs;
- weekly boundary inspections of ML 1535;
- regular checking of the main diesel tank and hydrogen peroxide tank concrete bund sumps after rainfall events to rescue and relocate frogs; and
- daily and weekly fauna incident inspections and field patrols.

6.9.2.2 Performance Outcomes

Reported Fauna Deaths

There were a total of 90 fauna incidents on ML 1535 during the reporting period. All injured or deceased fauna were taken to the local vet for examination. Over two thirds of the fauna incidents were reported as motor vehicle accidents while none were reported as cyanide related (Graph 1).

Graph 1: Graph of Fauna Deaths for the Reporting Period



Lake Cowal Waterbird Monitoring

The long-term monitoring of bird breeding continued during January, August and November of the reporting period. A summary of monitoring results undertaken by Professor Peter Gell (2016a, 2016b, 2016c) during the reporting period is provided below. The location of waterbird monitoring transects are presented on Figure 8.

January 2016

The first survey for 2016 was carried out on 29 January 2016. While the region had received average January rainfall, this level was insufficient to bring water in proximity to the transects. The level of rainfall was also insufficient to bring surface water to the colonial breeding areas to the north of Lake Cowal. As transect surveys undertaken at this time would not be comparable to those previous, no surveys were attempted (Gell, 2016a).

Six Australian Wood Ducks, eight Black Cormorants and three Hoary-headed Grebes were incidentally observed at the small dam at the northern end of T8, however no waterbirds were observed on the lake floor.

August 2016

Lake Cowal was visited on 8 and 9 August 2016. Recent rainfall had transformed Lake Cowal from a largely dry system to a productive wetland almost reaching its maximum extent. At this lake level the areas of shallow margins were extensive and harbour wading (stilt, avocets) and dabbling duck species. The lake was also deep enough to cater for birds typical of deeper waters e.g. Eurasian Coot and Grebes. This transitional state led to a species richness that was moderately high for winter surveys. This filling phase was not sufficiently mature to provide resources for fish-eating species (e.g. cormorants) whose numbers were low.

Some ducklings and a nesting swan were observed marking an early start to the breeding season. The presence of many birds in nuptial plumage, and the number of ducks frequenting tree hollows, suggests the recent rain had prompted breeding behaviour in many species. The lake level was sufficiently high for these non-colonial species to breed successfully (Gell, 2016b).

November 2016

Lake Cowal was visited on 23 and 24 November 2016. Recent extreme rainfall had flooded the region precluding an October survey. Floodwaters had receded sufficiently for a survey to be completed in November. The lake water was higher than during any previous survey (since 1989) and the margins were within metres of lakeside roads. Given that the conditions were so unusual, the shift from October to November is not considered to be the main influence on bird numbers or breeding activity.

Flooding had transformed Lake Cowal from a largely dry system the previous year. Extensive shallow habitat was lost to deep water margins and so wading birds were replaced by those that inhabit deeper waters or are attracted to the lake during filling. Shallows were evident at the end of T7 where farmland remained inundated. This combination of conditions yielded a high diversity of species, equivalent to surveys undertaken when the lake last filled. The narrowing of the margins reduced the littoral habitat and so the total number of birds was low again, relative to the large numbers recorded when the lower water level allows for more extensive shallows. While deep water, and early stage species were recorded, the total count was dominated by ducks, particularly Grey Teal.

There were 25 clutches of ducklings observed hosting 177 young birds. Being tree nesters they were able to nest even when the lake was flooded. Similarly, tree nesting species such as Great and Pied Cormorant, White-necked Heron and Yellow-billed Spoonbill had commenced breeding despite the high water. Most species that use lignum to nest had a delayed onset to breeding although breeding by a pair of Magpie Geese was well advanced, with three eggs evident in one nest. Magpie Geese have not been recorded breeding in these regular surveys before (Australian Museum Business Services, 2013) but they have been increasingly recorded breeding in the region (Paul Peake, pers. comm. 2013).

Fauna Monitoring of TSFs and ML 1535 Boundary

Fauna usage reports in relation to the TSF areas were prepared by Donato Environmental Services (DES) (2016; 2017) during the reporting period being, 1 January 2016 to 30 June 2016 and 1 July 2016 to 31 December 2016, respectively.

The main findings of the reports included:

- The cyanide discharge concentrations were below those required by the Development Consent.
- Monitoring of cyanide concentrations within the active TSFs and other water bodies has been conducted frequently and at a high standard consistent with industry best practice.
- Considering currently accepted knowledge of cyanide toxicosis in the gold industry, the range of concentrations reported at CGO are considered benign to wildlife.
- No cyanide-related wildlife mortality or effect was recorded at the TSFs. On 13 August 2016 an unknown bird species was observed stuck in mud, it was unable to be retrieved for a veterinary assessment. WAD cyanide concentrations measured for the seven days prior to the discovery at the spigot and supernatant were well below concentrations required by the Development Consent and at a level that is benign to wildlife.
- No insectivorous bat deaths were recorded at the TSF during the current monitoring period or since systematic wildlife monitoring commenced in April 2006.
- Nocturnal surveys indicate that insectivorous bats were consistently present in the airspace above the active TSF and the control site.
- Monthly nocturnal surveying conducted at CGO represents a proactive approach to environmental monitoring and it is clearly best practice methodology employed by a gold mining operation in Australia and internationally.
- Birds were the only diurnal vertebrate wildlife recorded to visit and interact with the active TSFs.
- The frequency of systematic wildlife surveys makes it very unlikely that cyanide-related wildlife deaths were occurring undetected.
- Rainfall patterns were not the sole influence on wildlife patterns during the reporting period.
- Lake Cowal is considered to be a vital influence in the composition and abundance of species occurring at the TSFs.

6.9.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.9.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.10 WEEDS AND PESTS

General weed and pest management activities within ML 1535 and the offset areas have been managed during the reporting period in accordance with the Land Management Plan (LMP), the FFMP and the BOMP.

6.10.1 Environmental Management

6.10.1.1 Control Strategies

In accordance with the LMP, FFMP and the BOMP, the control strategies for weed management on Evolution-owned land (including the offset areas) include the following:

- identification of weeds by regular and annual site inspections;

- communication with other landholders/leaseholders and regulatory authorities to keep weed management practices in line with regional weed control activities;
- mechanical removal of identified noxious weeds and/or the application of approved herbicides in authorised areas (herbicide use in wetland areas will be strictly controlled);
- implementing follow-up site inspections to determine the effectiveness of the weed control measures;
- where practicable, prevention of the establishment of new weeds on Evolution-owned land by minimising seed transport of weed species to and from the CGO through the use of a vehicle wash bay (primarily for use on agricultural and earthmoving equipment that are likely to carry weed seeds); and
- pest control activities.

The implementation of weed management strategies typically occurs according to seasonal and climatic requirements.

The pest control activities within ML 1535 and the offset areas described in the LMP, FFMP and the BOMP include the following measures:

- regular property inspections to assess the status of pest populations within Evolution-owned land;
- mandatory pest control for declared pests (i.e. rabbits, pigs and wild dogs) in accordance with Pest Control Orders under the NSW *Local Land Services Act, 2013*; and
- inspections to assess the effectiveness of control measures implemented and review these if necessary.

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

6.10.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.10.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.10.2 Environmental Performance

6.10.2.1 Monitoring

In accordance with the LMP, the FFMP and the BOMP, Evolution has implemented a weed monitoring program at the CGO. Evolution-owned land including the offset areas continues to be surveyed for weeds annually. Follow-up inspections are also to be made for specific areas following the implementation of weed control measures (to assess the success of the weed controls). Weed monitoring is to be conducted by suitably qualified personnel from a slow moving vehicle.

Weed monitoring includes identification of:

- extent of weed occurrence (noxious or otherwise);
- details of weed distribution (i.e. locations of infested areas) and possible reasons for any infestations (e.g. a change in land use practices);
- optimum herbicide application or physical removal timing (for implementation of controls);
- any resistance to a herbicide type or herbicide application technique (on the basis of success of previous controls); and
- identification of any new weed species that may be carried into the CGO area on vehicles accessing the site and become established near the vehicle wash-down area.

6.10.2.2 Performance Outcome

Weed Management

During the weed survey undertaken during the reporting period, six noxious weeds were recorded (NGH Environmental, 2017).

The overall abundance of Lippia was similar to the previous reporting period surveys. However Lippia was found to be highly abundant around areas on the lake fringe and nearby watercourses. Lippia was also in higher abundance in areas that had recently been inundated from the recent floods

Scattered individuals of African Boxthorn were observed during this survey and require attention and ongoing monitoring to ensure that spreading of this weed does not occur in the future; these were mainly isolated plants under mature trees. However the abundance of African Boxthorn appears to be declining in comparison with the 2015 survey (NGH Environmental, 2016).

Noogoora Burr was recorded during the reporting period; it had not been recorded in previous reporting periods. Most of the locations are along the floodplain and creek of Lake Cowal. Noogoora Burr seeds can float on water and it is likely their spread has been contributed to by the recent flooding of Lake Cowal.

Lippia, Bathurst Burr and Galvanised Burr were found on Transect 47; part of a new property recently purchased by Evolution Mining and it is unlikely previous weed control had been carried out prior to the acquisition. A small patch of Scotch Thistle was located on Transect 6, however we not observed on any other transects.

Areas of concern include disturbed areas that were over grazed which require ongoing monitoring and spot spraying especially after suitable rainfall events to ensure outbreaks do not occur at these areas. Other areas of concern include sites where soil moisture is likely to be retained such as moist depressions and around dams.

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Pest Management

A pest eradication program continued during the reporting period using collapsible traps and 1080 Fox baits. Pindone treated poison carrots were not laid during the reporting period. The population of pest within ML 1535 was not a concern during the reporting period, as observations of pests were low.

6.10.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.10.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.11 ABORIGINAL HERITAGE

The IACHMP was prepared in accordance with Development Consent Condition 3.1(a)(ii) to describe salvage, excavation and monitoring of archaeological heritage within the CGO area prior to and during development.

Monitoring and management of indigenous archaeology and cultural heritage continued in accordance with the IACHMP and relevant permits and consents (under section 87 and section 90 of the NPW Act during the reporting period.

6.11.1 Environmental Management

6.11.1.1 Control Strategies

The IACHMP sets out the salvage, excavation, monitoring and other management measures that have been undertaken for each of the registered archaeological sites and other Aboriginal objects within the CGO area. The management measures include strategies for registered sites and other Aboriginal objects.

In general, the strategies include: protection; investigation; collection; excavation; documentation and storage of Aboriginal objects in an on-site temporary “Keeping Place”; and collection and storage of objects during topsoil stripping and stockpiling.

During the reporting period, a total of eight registered sites were remaining within the ML 1535 boundary. Registered Sites (exposures) B, C, D, E and H were subject to ongoing conservation works during the reporting period including covering by geo-textile blanket and sign posting to protect the site. Should the location of these sites be proposed to be utilised, the procedure detailed in Special Condition 8 of Permit 1468 would apply after notice is provided to the Director-General of the OEH and in consultation with the local Aboriginal community.

Sites LC2, LC3 and LC4 are managed in accordance with Special Conditions 6, 12 and 13 of Permit 1468.

Management measures are not limited to registered sites. Permit 1468 and Permit 1681 authorise a range of management measures proposed in the Research Design and Study Plan for other Aboriginal objects in the CGO area that are not contained within the Registered Sites. The details of the management and mitigation measures for other Aboriginal objects is contained in the Research Design and Study Plan (Pardoe, 2002) for the CGO as amended by Permit 1468 and Permit 1681.

Activities undertaken during the reporting period included the following:

- Wiradjuri monitors from the Wiradjuri Condobolin Cultural Heritage Company (WCCHC) have been employed during the year on archaeological works at CGO.
- Dr Colin Pardoe was engaged to conduct cultural heritage inspections with WCCHC in areas identified as having a higher likelihood of artefacts present.
- The majority of cultural heritage work continues to be surface and subsurface monitoring for exploration drill pads and roads.

6.11.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.11.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period

6.11.2 Environmental Performance

6.11.2.1 Monitoring

During the reporting period, Wiradjuri monitors inspected proposed exploration areas within ML 1535. Access tracks and drill pads off lease were also inspected with no ‘datable materials’ identified during the inspections or during the works. All construction earthworks during the reporting period were monitored by Wiradjuri monitors and/or an archaeologist.

6.11.2.2 Performance Outcomes

No non-compliance issues were reported.

During Native Title Deed review discussions in 2016, the Wiradjuri Condobolin Corporation identified no need for any amendments to the IACHMP.

6.11.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.11.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.12 EUROPEAN HERITAGE

The Heritage Management Plan (HMP) was prepared in accordance with Development Consent Condition 3.1. Monitoring and management of European heritage continued in accordance with the HMP during the reporting period.

6.12.1 Environmental Management

6.12.1.1 Control Strategies

An interpretive display has been established at the Lake Cowal Conservation Centre (LCCC) in consultation with the Lake Cowal Foundation (LCF), BSC and Bland District Historical Society. The display includes maps, photographs, narrative, and fragments/elements salvaged from the Cowal West Homestead Complex to illustrate its history. Other items containing a level of local heritage significance identified in the HMP will continue to be maintained in accordance with the HMP.

6.12.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.12.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.12.2 Environmental Performance

6.12.2.1 Monitoring

Inspections of heritage sites are conducted periodically in accordance with the HMP.

6.12.2.2 Performance Outcomes

The maintenance works carried out within the Lake Cowal Homestead during the reporting have been effective in preserving the integrity and heritage value of the buildings.

6.12.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.12.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.13 BUSHFIRE

Development Consent Condition 3.6 and the Emergency Response Plan (ERP), ROMP and BOMP describe fire preventative measures and fuel management measures for the mine site, CGO rehabilitation areas and CGO offset areas.

Monitoring and management of bushfire risk continued in accordance with Development Consent Condition 3.6, the ERP, ROMP and BOMP during the reporting period.

6.13.1 Environmental Management

6.13.1.1 Control Strategies

In accordance with the ROMP and BOMP, bushfire preventative and control strategies for the CGO and the CGO offset areas include:

- educating employees and contractors on general fire awareness and response procedures;
- fire track (and fire break) maintenance for fire control;
- annual inspections to identify areas requiring bushfire control measures including assessment of fuel loads; and
- fuel management (e.g. hazard reduction burns) in consultation with the NSW Rural Fire Service.

6.13.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators

6.13.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.13.2 Environmental Performance

6.13.2.1 Monitoring

In accordance with Development Consent Condition 6.2, data from the meteorological station maintained on-site was used to determine whether current weather conditions were suitable for fire management activities, and to assist in the management of bushfire fighting activities.

The Kattron lightning tracking system was introduced to operations in early-2012. The Mining Dispatch Control Room operators continually monitor and pass on alert levels between red, orange and yellow to other employee groups and the Emergency Response Team until all clear conditions resume.

6.13.2.2 Performance Outcomes

There were no uncontrolled bushfires within ML 1535 or the biodiversity offset areas during the reporting period.

The fire trail register was maintained during the reporting period. A number of all-weather access tracks are established and have been maintained during the reporting period – within the ML 1535, on Evolution-owned land and within Lake Cowal.

6.13.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.13.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.14 HYDROCARBON CONTAMINATION

A Hazardous Waste and Chemical Management Plan (HWCMP) has been prepared for the CGO in accordance with Development Consent Condition 5.7. Monitoring and management of hazardous waste and chemicals continued in accordance with the HWCMP during the reporting period.

6.14.1 Environmental Management

6.14.1.1 Control Strategies

Based on the principles detailed in *Leading Practice Sustainable Development Program for the Mining Industry - Hazardous Materials Management* handbook (Department of Foreign Affairs and Trade, 2016), Evolution employees and contractors have adopted a Chemical Management Strategy as part of the HWCMP. This strategy allows for the management of each chemical used at the CGO.

Control strategies include:

- Site wide inductions, awareness and training on Hazardous Substances and Hydrocarbon spill response.
- Annual concrete bunding and tankage integrity audits.
- Area planned general inspections.
- Hazardous Substance and Dangerous Goods Register.
- Incident reporting and follow up action items.

6.14.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.14.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.14.2 Environmental Performance

6.14.2.1 Monitoring

Hydrocarbon contamination continued to be monitored during the reporting period in accordance with the HWCMP.

6.14.2.2 Performance Outcomes

A number of minor substance spillage incidents occurred during the reporting period, however these spills were classified as low risk and were fully contained and treated in the bioremediation facility.

6.14.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.14.4 Further Improvements

No further improvements were implemented during the reporting period.

6.15 WASTE GEOCHEMISTRY

During annual on-site AR performance review meetings in 2005 and 2006, the then DPI Mineral Resources requested confirmatory test-work of waste rock geochemistry to be undertaken. In their 2007 report, the Independent Monitoring Panel also recommended that Evolution continue to monitor the waste rock being removed from the open pit, to facilitate identification of potentially acid-generating material (if present) and selective placement of that material within the waste emplacements.

6.15.1 Environmental Management

The regional and local geology of the E42 Deposit has been described by Miles, Brooker, McInnes, *et al* [1993-1998]). The complex consists of calc-alkaline to shoshonitic volcanic rocks and related sedimentary rocks deposited in a deep water environment and are unconformably overlain, in parts, by the Siluro-Devonian Manna Conglomerate. The auriferous quartz-carbonate-sulphide and carbonate-quartz-sulphide veins occur throughout the deposit and have a consistent dip of 305° and dip of 35° to the southwest.

McInnes *et al.* (1998) describe the gold-bearing veins as generally being associated with one of two alteration styles: ankerite-quartz-pyrite-sphalerite-chalcopyrite-galena veins, which are associated with ankerite-quartz-sericite-carbonate alteration; and quartz, potassium feldspar, pyrite, sphalerite, and chalcopyrite veins associated with the chlorite-carbonate-pyrite alteration. Oxide blankets occur at the base of tertiary transported lacustrine cover, saprolite-saprock transition and at the base of oxidation (*pers. comm*, McInnes, Freer (2007)). These flat lying blankets can be up to several hundred metres wide and 1 m to 15 m thick and are interpreted to have formed as a result of remobilisation of gold during weathering processes in association with water table fluctuations.

6.15.1.1 Control Strategies

Based on prior test work there is no indication that the E42 Deposit or the process tailings are acid forming (Environmental Geochemistry International Pty Ltd [EGi], 2004; and Geo-Environmental Management [GEM], 2009; 2013). Overall, the EGi (2004) results indicated a very low likelihood of Acid Rock Drainage (ARD) generation from waste rock, Carbon in Leach tailings and combined primary tailings represented by the samples included in the testing programs. Therefore, no special handling requirements were indicated for ARD control at the CGO. However, operational monitoring and testing was recommended to be a carried out on an occasional and as needed basis to confirm the low ARD potential of all waste types with particular focus on any unexpected rock types or alteration types which may be exposed during mining.

Chemical groundwater data will continue to be collected as part of the groundwater monitoring programme detailed in the SGWMBMP. Leachate water quality monitoring will continue to be undertaken at the NWRE, SWRE and PWRE external toe drain points in accordance with the EPL 11912.

6.15.1.2 Effectiveness of Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

6.15.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

6.15.2 Environmental Performance

The results of detailed geochemical investigations of waste rock and tailings were reported in the EIS and in subsequent environmental assessments undertaken for the CGO. The ongoing drilling and metallurgical testing carried out by Barrick (before Evolution), during the reporting period provided the opportunity to update the geochemical database for the project and to verify the findings of previous studies by EGi (2004) and GEM (2009; 2013). Ongoing periodic field observations undertaken during the reporting period confirmed the low salinity potential of waste hard rock types mined during the reporting period.

Barrick commissioned O'Kane in late-2007 to conduct repeat test work of the Waste Rock Emplacement and the contents of the TSFs. O'Kane representatives visited site to obtain samples in January 2008. A report was delivered in June 2008 (O'Kane, 2008) and was provided to the DRE. O'Kane (2008) concluded that the results are generally consistent with previous investigations, which predicated that waste rock would be predominantly non-acid forming. GEM (2009) also verified these findings.

Small seepages at the NWRE and SWRE are sampled for water quality on a monthly and quarterly basis. This was reported to the ICDS. There has been some localised stormwater run-off in areas that are yet to undergo final rehabilitation treatment.

6.15.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.15.4 Further Improvements

No further improvements were implemented during the reporting period.

7 WATER MANAGEMENT

7.1 WATER SUPPLY

Water taken by CGO during the reporting period is summarised in Table 20 below.

Table 20: Water Taken for CGO

Water Licence #	Water Sharing Plan, Source, Management Zone	Entitlement (ML)	Passive Take/Inflows	Active Pumping (ML)	TOTAL
WAL 31864 (BCPC)	*Water Sharing Plan for the Lachlan Unregulated and Alluvial Water Sources 2012.*	15ML/day and 3,650ML/yr	-	948.4	948.4
WAL 36569 (ESB)	Upper Lachlan Alluvial Groundwater Source. Upper Lachlan Alluvial Zone 7 Management Zone	0 ML (with temporary transfer of 750 ML per bore per yr)	-	170.4	170.4
WAL 36615 (Saline groundwater supply borefield within ML 1535 and pit dewatering bores)		3,660 ML/yr	-	-	-
WAL 36617 (pit dewatering)	*Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2011.* Lachlan Fold Belt Murray Darling Basin Groundwater Source. Lachlan Fold Belt Mdb (Other) Management Zone	3,294 ML/yr	957	15.7	972.7
WAL 13749 (High Security Title)	*Water Sharing Plan for the Lachlan Regulated River Water Source 2003.* Lachlan Regulated River Water Source. That Part Of The Water Source Upstream Of Lake Cargelligo Weir.	Zero share component enabling temporary trade of water from regulated Lachlan River source.	-	135	135
WAL 13748 (General Security)			-		
WAL 14981 (High Security Title)	*Water Sharing Plan for the Lachlan Regulated River Water Source 2003.* Lachlan Regulated River Water Source. That Part Of The Water Source Downstream Of Lake Cargelligo Weir.	80 unit shares.	-		

Notes: ML – megalitre; ML/day – megalitres per day; ML/year – megalitres per year.

7.1.1 Groundwater

The quantity of water approved to be extracted from the BCPC is limited by:

1. Development Consent Condition 4.1(b) which states:

   The maximum daily extraction of water from the Bland Creek Palaeochannel shall not exceed 15 ML/day, or 3,650 ML/year; and

2. The current bore water licences.

A total of 948.4 ML of water was extracted from the BCPC borefield during the reporting period (Table 20). The groundwater level associated with the BCPC borefield is monitored on a continuous basis by the DPI-Water groundwater monitoring bore on Burcher Road (GW036553). Contingency measures have been developed for implementation when water levels reach either RL 137.5 m AHD or RL 134 m AHD. These trigger levels were developed in consultation with the then NSW Office of Water (NoW) and other water users within the BCPC including stock and domestic users and irrigators. The trigger levels were not reached during the reporting period.

In addition, as agreed with the then NoW and BCPC Water Users Group, Evolution conducted regular surveys to monitor 11 monuments on the east side of Lake Cowal for any evidence of soil compaction. Monitoring of these monuments has indicated no significant movement to date and shows no specific trends that would be of concern.

Development Application No. 2011/0064 was granted by the FSC on 20 December 2010 for the construction and operation of the ESB, located approximately 10 km east of Lake Cowal's eastern shoreline (Figure 7). Water extraction from the ESB is licensed under WAL 36569. The total volume extracted from the ESB during the reporting period was 170.4 ML. The annual maximum extraction limit is 750 ML per bore.

The saline groundwater supply borefield on the floor of Lake Cowal within ML 1535 (Figure 9a) was commissioned in mid-2009. Water extraction from the saline groundwater supply borefield within Lake Cowal is licensed under WAL 36615. However, no extraction has occurred since April 2010 due to access restrictions resulting from the inundation of Lake Cowal. The production and monitoring bores on the floor of Lake Cowal remain capped. Access via a gravel track to these bores was reinstated during 2015, however extraction from these bores did not occur during the reporting period as this water was not required.

An open pit dewatering borefield has been established external to the perimeter of the open pit. A total of 15.7 ML was extracted from the open pit borefield, and a further 957 ML extracted from the open pit dewatering sump (which collect water from rock wall seepage and rainfall) during the reporting period. Water extraction from the open pit dewatering borefield is licensed under WAL 36615 and WAL 36617.

Extracted water was used mainly for ore treatment within the processing plant, dust suppression on haul roads and soil conditioning to achieve optimal compaction rates during TSF lift construction works.

7.1.2 Surface Water

A total of 135 ML was pumped from the Jemalong Irrigation Channel during the reporting period due to the relatively drier conditions. The Jemalong Irrigation Channel water was purchased from the regulated Lachlan River trading market.

Water access from the Lachlan River Regulated Water Source is licensed under Evolution's High Security WALs 14981 and 13749 (80 Units) and General Security (zero allocation) WAL 13748. Licenced water from the Lachlan River is supplied via a pipeline from the Jemalong Irrigation Channel to the BCPC Bore 4 pumping station (Figure 9b).

The CGO water management system is conceptually shown in Figure 10.

The CGO's Water Management Plan (WMP) and MOP (2016 – 2018) provide further detail regarding water management at the CGO. The long-term strategy for decommissioning water management structures (within the WMP) was also updated to include the new water management components associated with the approved CGO (i.e. the new contained water storage D10 and the modified design of contained water storage D5).

7.2 SURFACE WATER

The WMP and the SWGMBMP have been prepared in accordance with Development Consent Conditions 4.4(a) and 4.5(b) (and other relevant Development Consent Conditions) to guide water management and detail the CGO's water monitoring programme, respectively. The WMP and the SWGMBMP were approved on 19 November 2015.

Monitoring and management of surface water during the reporting period has been undertaken in accordance with relevant Development Consent Conditions, the WMP, the SWGMBMP and the EPL 11912.

7.2.1 Environmental Management

7.2.1.1 Control Strategies

The site water management system is designed to contain all potentially contaminated water and comprises the following major components:

(i) Up Catchment Diversion System (UCDS).

(ii) Lake Isolation System (comprising the Temporary Isolation Bund (TIB), Lake Protection Bund (Lake Protection Bund) and PWRE.

(iii) Internal Catchment Drainage System (including the permanent catchment divide and contained water storages).

(iv) Integrated Erosion and Sediment Control System.

(v) E42 Open Pit Dewatering System.

The site water management system is designed to contain all potentially contaminated water generated within the closed catchment of the ML 1535 area while diverting all other water around the perimeter of the site. The UCDS, Lake Isolation System and Internal Catchment Drainage System are designed to minimise the volume of surface water entering ML 1535 by isolating the site from Lake Cowal and the up-slope catchment above the UCDS. Surface water collected within ML 1535 is controlled using a number of water management structures which are designed to prevent discharge to Lake Cowal. No discharge to Lake Cowal has occurred to date or during the reporting period.

7.2.1.2 Effectiveness of the Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

7.2.1.3 Variations from Proposed Control Strategies

There were no variations from the proposed control strategies during the reporting period.

7.2.2 Environmental Performance

7.2.2.1 Monitoring

During the reporting period surface water monitoring was conducted in accordance with the WMP, SWGMBMP and EPL 11912. Surface water monitoring locations within ML 1535 are shown in Figure 9a.

7.2.2.2 Performance Outcomes

Surface Water Quality

pH, electrical conductivity (EC) and Total Suspended Solids (TSS) results fluctuated across the on-site surface water ponds throughout the reporting period due to changes in the standing water level within the ponds. pH results ranged from 6.5 to 10.1 across the on-site surface water ponds and was generally stable throughout the reporting period. EC ranged from 26 to 112,400 microSeimens per centimeter (µS/cm) and TSS ranged from <1 to 531 milligrams per litre (mg/L) and were both significantly influenced by the filling and drying of the ponds with increases observed in the summer months due to decreasing standing water levels (Table 21).

These monitoring results and fluctuations are consistent with previous reporting periods.

A comparison of surface water results with the Australian and New Zealand Environmental Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000) guidelines has not been undertaken for on-site surface water ponds as they are contained inside a closed catchment in the mining lease area. The closed catchment is engineered to contain all runoff on the mining lease and physically separates mine water from offsite waters in the upstream diversion drains and Lake Cowal**.**

Table 21: Summary of Weekly, Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Weekly Surface Water Monitoring - D1, D4, UCD North and UCD South				
Dam D1	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	57	6.5	10.1	8.3
Electrical Conductivity - Field (µS/cm)	57	1542	16060	6629
Total Suspended Solids (mg/L)	57	2	325	48
Dam D4	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	57	6.7	9.2	7.9
Electrical Conductivity - Field (µS/cm)	57	3719	112400	24956
Total Suspended Solids (mg/L)	57	<1	531	45
UCD North	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	56	6.5	9.7	8.0
Electrical Conductivity - Field (µS/cm)	54	92	1858	601
Total Suspended Solids (mg/L)	53	4	203	64
UCD South	**COUNT**	**MIN**	**MAX**	**MEAN**
pH – Field	57	6.8	9.5[#]	8.5
Electrical Conductivity - Field (µS/cm)	56	26	2335	666
Total Suspended Solids (mg/L)	56	7	356	68
Monthly Surface Water Monitoring – D5, D6 and Pit Sumps				
Dam D5	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	14	7.3	8.9	8.1
Electrical Conductivity - Field (µS/cm)	14	122	33800	10837
Dissolved Oxygen - Field (mg/L)	13	5.92	11.33	8.13
Temperature (Deg C)	14	13.5	26.3	19.3
Turbidity (NTU)	10	0.4	55.5	10.0
Dam D6	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	14	7.2	8.4	7.7
Electrical Conductivity - Field (µS/cm)	14	204	36450	15985
Dissolved Oxygen - Field (mg/L)	13	1.63	7.77	6.64
Temperature (Deg C)	14	14.8	28.2	21.0
Turbidity (NTU)	10	2.7	227	47.1
Pit Sump 1	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	12	6.6	8.0	7.0
Electrical Conductivity - Field (µS/cm)	12	12660	47280	31289
Total Suspended Solids (mg/L)	12	<1	12	3
Quarterly Surface Water Monitoring – D2, D3, D8B, D9, D6				
Dam D2	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	3	8.0	8.6	8.3
Electrical Conductivity - Field (µS/cm)	3	7524	16910	12949
Oil & Grease (mg/L)	3	< 5	< 5	< 5
Dam D3	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.9	8.6	8.2
Electrical Conductivity - Field (µS/cm)	4	7935	44240	22219
Oil & Grease (mg/L)	4	< 5	< 5	< 5

Table 21 (Continued): Summary of Weekly, Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Dam D9	COUNT	MIN	MAX	MEAN
pH - Field	4	7.6	8.5	8.1
Electrical Conductivity - Field (µS/cm)^	4	11223	21190	14808
Oil & Grease (mg/L)	4	< 5	< 5	< 5
Dam D6	**COUNT**	**MIN**	**MAX**	**MEAN**
Antimony - Total	2	0.008	0.008	-
Arsenic - Total	2	0.004	0.006	-
Biochemical Oxygen Demand	2	<2	62	-
Cadmium - Total	2	<0.0001	0.0024	-
Calcium - Dissolved	4	130	962	475
Chloride	4	1010	10100	4585
Coliforms	3	< 1	<2	-
Copper - Total	2	0.451	1.01	-
Enterococci	2	< 1	< 1	-
Escherichia coli	2	< 1	< 1	-
Faecal Coliform -Total	2	< 1	< 1	-
Iron - Total	2	0.58	3.45	-
Lead - Total	2	0.001	0.002	-
Magnesium - Dissolved	4	45	670	319.3
Manganese - Total	2	0.155	0.663	0.409
Mercury - Total	2	< 0.0001	< 0.0001	-
Potassium - Dissolved	2	80	337	185.8
Selenium - Total	2	<0.01	0.02	-
Sodium - Dissolved	4	861	5140	2540.3
Sulfates	4	892	2090	1475
Total Dissolved Solids	4	3090	25000	11380
Total hardness as CaCO3	4	510	5160	2502.5
Total Suspended Solids	12	<1	93	34.3
Zinc - Total	2	0.030	0.054	-
Dam D8B	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.1	8.7	8.2
Electrical Conductivity - Field (µS/cm)^	4	6438	15950	11121
Oil & Grease (mg/L)	4	< 5	< 5	< 5

^ Dam D9 was used as storage for water collected from surface water runoff dams after heavy rain.
# An initial pH recording of 11.2 was a suspected transcription error and removed from the data set for UCD South.

UCD North and UCD South which collect upstream water flowing through diversion channels around the perimeter of the closed catchment were both inundated during the flooding of Lake Cowal. Therefore sampling results post inundations in August are reflective of lake water quality rather than diversion water.

pH, EC and TSS results fluctuated across both UCD North and UCD South throughout the reporting period due to changes in the standing water level within the ponds. pH results ranged from 6.5 to 9.7 across both ponds and was generally stable throughout the reporting period. One outlying reading of pH 11.2 was recorded on 14 November 2016, however external results for this location were pH 8.11 and it is assumed this is a transcription error.

EC ranged from 25.8 to 2,335 µS/cm and TSS ranged from 4 to 356 mg/L and were both significantly influenced by two factors, fluctuations due to changes in standing water levels and the lake water inundating the dams. A significant drop in EC occurred in the June period and continued at that level throughout the year post inundation.

These monitoring results and fluctuations due to changes in standing water levels are consistent with previous reporting periods and base line monitoring results for the 1991-1992 periods which are above the ANZECC and ARMCANZ (2000) guidelines for pH, EC and Turbidity.

Lake Cowal

During the reporting period, Lake Cowal was completely inundated following high rainfall events throughout the winter months and subsequent flooding of the Lachlan River and Bland Creek (Plate 2).

Plate 2: Aerial Photograph of the Lake Protection Bund

Lake Cowal peaked at a height of 207.49 m RL on 10 October 2016, before steadily receding back to 205.9 m RL by the end of 2016 (Graph 2).

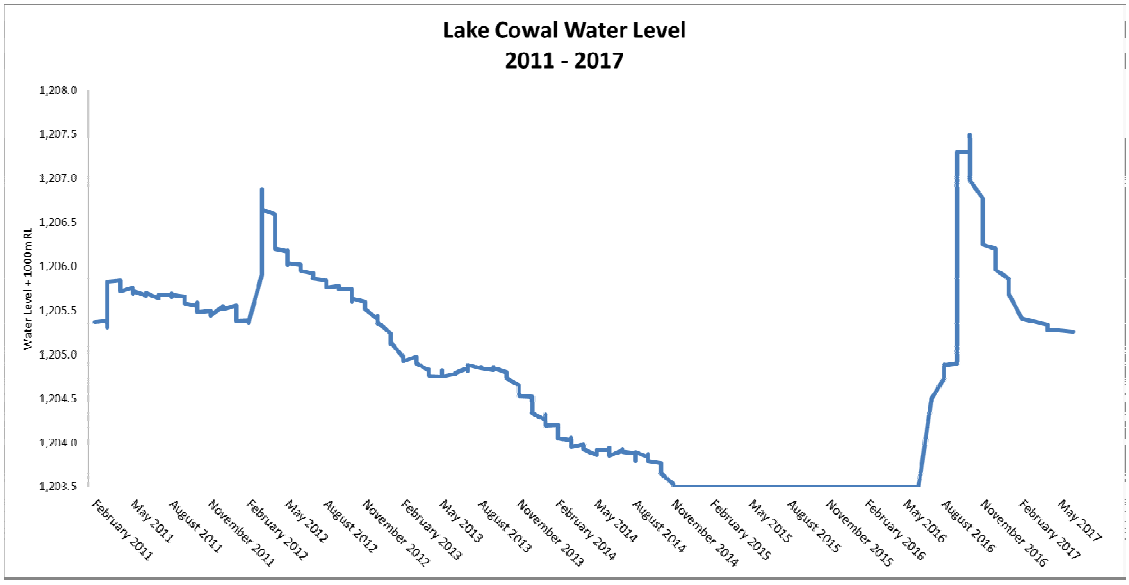
Lake Cowal Water Quality

Water quality monitoring at Lake Cowal was undertaken by DM McMahon Pty Ltd (2016), including a detailed description and interpretation of the results. Key summaries of the lake water monitoring results (DM McMahon, 2016) are provided in the subsections below.

A comparison of the 2016 Lake Cowal surface water quality results against the baseline water quality results from 1991 – 1992 and 2010-2014 indicates that the 2016 monitoring results are generally similar.

A comparison of the 2016 Lake Cowal surface water quality results against the ANZECC and ARMCANZ (2000) default trigger values for surface water (lakes) indicates that the 2016 monitoring results (totals and dissolved) were below or marginally above the default trigger values. Heavy metal readings are similar to historical data. Overall, the pH and EC are within the range of values previously recorded.

Graph 2: Lake Cowal Water Level 2011 - 2017



pH and Electrical Conductivity

pH results ranged from 7.05 to 8.76 with a mean of 7.8. This is slightly lower than the baseline water quality data collected in 1991 – 1992**,** with the maximum being slightly above the ANZECC and ARMCANZ (2000) upper level of 8.0 and 2012 results (Table 22).

EC results ranged from 119 to 1350 µS/cm with a mean of 583 µS/cm which is mid to high range of the baseline data and also higher than the ANZECC and ARMCANZ (2000) level of 30 µS/cm for slightly disturbed ecosystems (lakes). However, ANZECC and ARMCANZ (2000) note that conductivity in lakes will vary depending on catchment geology (Table 22). These results are slightly lower than the baseline water quality data collected in 1991 – 1992.

Turbidity and Suspended Solids

Turbidity results ranged from 57 to 644 mg/L NTU with a mean of 366 mg/L. The turbidity results are above the ANZECC and ARMCANZ (2000) level of 20 mg/L for slightly disturbed ecosystems (lakes). ANZECC and ARMCANZ (2000) note that lakes in catchments with highly dispersive soils such as Lake Cowal will have high turbidity (Table 22). These results are well above 2010-2012 values and are similar to upper values recorded in 2013 and 2014.

The suspended solids results ranged from 13 to 417 mg/L with a mean of 145 mg/L which is above the 2010-2012 results, similar to 2013 results and below 2014 results. The ANZECC and ARMCANZ (2000) recommended guideline trigger values for toxicants do not include a trigger value for suspended solids.

Dissolved Oxygen

Dissolved Oxygen results ranged from 0.08 to 8.57 mg/L with a mean of 6.46 mg/L is lower than the 2011 – 2014 results but similar to 2010 (Table 22). The ANZECC and ARMCANZ (2000) recommended a guideline range between 90% and 110% saturation which is a different scale (Table 3.3.2 ANZECC and ARMCANZ, 2000) to what was directly measured at Lake Cowal.

Heavy Metals (total and dissolved)

The mean 2016 monitoring for total heavy metals marginally exceeded the ANZECC and ARMCANZ (2000) default trigger values for Nickel, Lead and Zinc as was the case in previous years.

Table 22: Summary of Lake Cowal Water Monitoring – 2010 – 2016

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2015) Ranges (Mean)*	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Aquatic Ecosystems^ ~
Alkalinity (mg/L)	105	64 – 142 (100)	50 – 152 (87)	113 – 178 (157)	191 – 322 (269)	NA	44 – 356 (160)	NA	NA
Suspended Solids (mg/L)	6 - 192	5 – 184 (38)	7 – 274 (67)	66 – 472 (216)	57 – 556 (233)	NA	13 – 417 (145)	NA	NA
Acidity – Alkalinity scale (pH)	7.03 – 8.27	7.22 – 8.82 (8.14)	5.56 – 9.78 (7.81)	7.82 – 8.43 (8.19)	8.45 – 8.97 (8.72)	NA	7.05 – 8.76 (7.8)	8.27 – 8.67	6.5 to 8.0
Electrical Conductivity (µS/cm)	100 – 701	190 – 727 (322)	107 – 433 (236)	351 – 572 (503)	882 – 1350 (1193)	NA	119 – 1350 (583)	222 – 1557[1, 3]	20 to 30 µS/cm[1]
Turbidity (NTU)	8.2 – 211	11.5 – 144 (53.3)	7.8 – 829 (246.1)	271 – 755 (470)	189 – 671 (391)	NA	57 – 644 (366)	22 – 224	1 to 20[2]
Dissolved Oxygen (mg/L)	0.84 – 8.89	1.64 – 14.74 (9.76)	2.24 – 17.89 (8.95)	1.84 – 12.70 (9.03)	5.65 – 13.83 (9.0)	NA	0.08 – 8.57 (6.46)	7.3 – 11.5	90 to 110 (derived from daytime measurements)
Temperature (°C)	24.9	9.6 – 29.8 (18.4)	7.5 – 28.8 (16.7)	9.80 – 27 (17.4)	7.8 – 30 (18.6)	NA	11.7 – 27.3 (18.3)	NA	Not applicable
Depth (m)	0.10 – 1.20	0.60 – 2.50 (1.7)	0.50 – 3.60 (2.0)	0.40 – 2.00 (1.2)	0.25 – 1.0 (0.54)	NA	0.8 – 4.5 (2.6)	0.2 – 2.0	Not applicable
Lake Water Level (m)	204.5	205.25 – 205.75	205.40 – 206.88	204.33 - 205.24	203.5 - 204.78	NA	204.88 – 207.45	205.1	Not applicable
Total Iron (mg/L)	6.50	0.36 – 11.00 (2.50)	0.92 – 22.6 (9.55)	2.54 – 33.6 (21.49)	4.76 – 21.7 (11.7)	NA	4.05 – 21.7 (14.81)	NA	NA (insufficient data)

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2016

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2015) Ranges (Mean)*	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Aquatic Ecosystems^ ~
Calcium (mg/L)	17	10 – 26 (19)	8 – 28 (14)	22 – 32 (26)	20 – 50 (42)	NA	8 – 41 (22)	NA	NA
Magnesium (mg/L)	10	6 – 12 (9)	4 – 14 (7)	9 – 17 (13.4)	16 – 32 (29)	NA	4 – 32 (14)	NA	NA
Potassium (mg/L)	15	12 – 19 (15)	12 – 19 (14)	14 – 27 (21)	26 – 36 (31)	NA	5 - 27 (15)	NA	NA
Sodium (mg/L)	19	13 – 35 (24)	12 – 38 (22)	35 – 59 (50)	105 – 168 (144)	NA	9 – 164 (64)	NA	NA
Chloride (mg/L)	25	19 – 41 (28)	12 – 66 (22)	36 – 61 (51)	91 – 194 (155)	NA	9 – 194 (77)	NA	NA
Sulphate (mg/L)	3	1 – 10 (2)	1 – 10 (4)	14 -38 (21)	29 – 37 (33)	NA	1 - 37 (16)	NA	NA
Cations (mg/L)	2.81	1.98 – 3.77 (3.02)	1.56 – 3.82 (2.11)	3.74 – 5.85 (5.13)	8.85 – 12.6 (11.51)	NA	1.35 – 12.4 (5.4)	NA	NA
Anions (mg/L)	2.83	1.93 – 3.67 (2.91)	1.45 – 3.77 (2.00)	3.76 – 5.78 (5.02)	1.1 – 13.2 (11.05)	NA	0.35 – 13.2 (5.40)	NA	NA
Arsenic (mg/L)	0.006[3] (total)	<0.001 – 0.007 (0.003[3]) (total)	0.002 – 0.007 (0.004[3]) (total)	0.006 – 0.014 (0.009[3]) (total)	0.014 – 0.023 (0.018[3]) (total)	NA	0.002 – 0.02 (0.00748[3]) (total)	0.0026[3] (total)	0.008
	0.005[3] (dissolved)	<0.0003 – 0.006 (0.0026[3]) (dissolved)	0.001 – 0.006 (0.003[3]) (dissolved)	0.003 – 0.011 (0.007[3]) (dissolved)	0.012 – 0.024 (0.017[3]) (dissolved)	NA	0.0001 – 0.014 (0.00561[3]) (dissolved)	0.0016[3] (dissolved)	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2016

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2015) Ranges (Mean)*	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Aquatic Ecosystems^ ~
Cadmium (mg/L)	0.0001[3] (total)	<0.0001 - 0.001 (0.0001[3]) (total)	<0.0001 – 0.005 (0.0002[3]) (total)	0.0001 – 0.0002 (0.0001[3]) (total)	0.0001 – 0.0001 (0.0001[3]) (total)	NA	0.0001 – 0.0002 (0.0001[3]) (total)	0.000055[3] (total)	0.0006
	0.0001[3] (dissolved)	<0.0001 – 0.0004 (0.0001[3]) (dissolved)	<0.00001 – <0.0001 (0.00001[3]) (dissolved)	0.0001 – 0.0002 (0.0001[3]) (dissolved)	0.0001 – 0.0002 (0.0001[3]) (dissolved)	NA	0.0001 – 0.0001 (0.0001[3]) (dissolved)	0.00005[3] (dissolved)	
Molybdenum (mg/L)	0.001[3] (total)	<0.001 – 0.006 (0.0012[3]) (total)	<0.001 – 0.004 (0.001[3]) (total)	0.001 – 0.003 (0.0014[3]) (total)	0.002 – 0.005 (0.003[3]) (total)	NA	0.001 – 0.003 (0.0016[3]) (total)	NA	NA (insufficient data)
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.002 (0.0014[3]) (dissolved)	0.003 – 0.004 (0.035[3]) (dissolved)	NA	0.001 – 0.004 (0.0019[3]) (dissolved)	NA	
Nickel (mg/L)	0.007[3] (total)	<0.001 – 0.009 (0.0036[3]) (total)	<0.001 – 0.018 (0.009[3]) (total)	0.006 – 0.025 (0.018[3]) (total)	0.010 – 0.025 (0.016[3]) (total)	NA	0.004 – 0.025 (0.015[3]) (total)	NA	0.008
	0.004[3] (dissolved)	<0.001 – 0.004 (0.0023)[3] (dissolved)	<0.001 – 0.004 (0.003[3]) (dissolved)	0.002 – 0.005 (0.0035[3]) (dissolved)	0.004 – 0.007 (0.006[3]) (dissolved)	NA	0.002 – 0.007 (0.0052[3]) (dissolved)	NA	
Lead (mg/L)	0.003[3] (total)	<0.001 – 0.004 (0.0013[3]) (total)	<0.001 – 0.009 (0.004[3]) (total)	0.003 – 0.015 (0.009[3]) (total)	0.003 – 0.010 (0.006[3]) (total)	NA	0.002 – 0.011 (0.0067[3]) (total)	0.0029[3](total)	0.001
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – 0.003 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	NA	0.001 – 0.01 (0.0015[3]) (dissolved)	0.0005[3] (dissolved)	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2016

Parameter	Lake Cowal Water Quality Results (November 2010 – Mean[#])	Lake Cowal Water Quality Results (2011) Ranges (Mean)	Lake Cowal Water Quality Results (2012) Ranges (Mean)	Lake Cowal Water Quality Results (2013) Ranges (Mean)	Lake Cowal Water Quality Results (2014) Ranges (Mean)	Lake Cowal Water Quality Results (2015) Ranges (Mean)*	Lake Cowal Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)	Aquatic Ecosystems^ ~
Antimony (mg/L)	0.001[3] (total)	<0.001 – 0.004 (0.0014[3]) (total)	<0.001 – <0.001 (0.001[3]) (total)	0.001 – 0.001 (0.001[3]) (total)	0.001 – 0.050 (0.017[3]) (total)	NA	0.001 – 0.05 (0.017[3]) (total)	NA	NA (insufficient data)
	0.001[3] (dissolved)	<0.001 - 0.001 (0.001[3]) (dissolved)	<0.001 – <0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	0.001 – 0.001 (0.001[3]) (dissolved)	NA	0.001 – 0.0001 (0.001[3]) (dissolved)	NA	
Zinc (mg/L)	0.012[3] (total)	<0.005 – 0.038 (0.0074[3]) (total)	<0.005 – 0.04 (0.016[3]) (total)	0.008 – 0.079 (0.036[3]) (total)	0.009 – 0.047 (0.023[3]) (total)	NA	0.006 – 0.047 (0.028[3]) (total)	0.012[3](total)	0.0024
	0.015[3] (dissolved)	<0.005 – 0.022 (0.0109[3]) (dissolved)	<0.005 – 0.264 (0.035[3]) (dissolved)	0.005 – 0.067 (0.018[3]) (dissolved)	0.005 – 0.03 (0.011[3]) (dissolved)	NA	0.005 – 0.052 (0.014[3]) (dissolved)	0.00306[3] (dissolved)	

After: North Limited (1998).

^ Guideline values in accordance with ANZECC and ARMCANZ (2000).

~ 99% protection level trigger values for toxicants – lakes and reservoirs.

NA – Not Available.

[1] ANZECC and ARMCANZ (2000) notes that conductivity in lakes is generally low, but will vary depending upon catchment geology.

[2] ANZECC and ARMCANZ (2000) notes that lakes in catchments with highly dispersible soils will have high turbidity.

[3] Mean value.

Two readings only for December 2010.

* Lake Cowal was below 204.5 m RL during 2015.

Table 23: Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2016

Parameter	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2015) Ranges (Mean)*	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)[#]	Aquatic Ecosystems^ ~
Alkalinity (mg/L)	50	16 – 79 (56)	39 – 101 (67)	95 – 170 (133)	NA	NA	51 – 148 (78) [3]	NA	NA
Suspended Solids (mg/L)	14	11 – 201 (53)	23 – 372 (124)	210 – 640 (425)	NA	NA	4 – 63 (31) [3]	NA	NA
Acidity – Alkalinity scale (pH)	7.3	7.17 – 7.73 (7.37)	7.55 – 7.90 (7.73)	7.73 – 7.87 (7.80)	NA	NA	7.09 – 8.31 (7.52) [3]	8.27 – 8.67	6.5 to 8.0
Electrical Conductivity (µS/cm)	178	126 – 348 (199)	89 – 871 (246)	365 – 551 (458)	NA	NA	139 – 721 (262) [3]	222 – 1557[1, 3]	20 to 30 µS/cm[1]
Turbidity (NTU)	116	31 – 807 (237)	18.6 – 693 (296)	337 – 2560 (1449)	NA	NA	51 – 270 (122) [3]	22 – 224	1 to 20[2]
Total Iron (mg/L)	6.5	0.90 – 42.8 (10.7)	2.09 – 36.7 (13.68)	20.8 – 180 (100)	NA	NA	2.6 – 16.1 (8.6) [3]	NA	NA
Calcium (mg/L)	9	3 – 15 (8)	5 – 23 (11.3)	10 – 29 (19.5)	NA	NA	4 – 32 (15) [3]	NA	NA
Magnesium (mg/L)	5.5	2 – 9 (5)	3 – 16 (6.9)	6 – 15 (10.5)	NA	NA	3 – 28 (8.4) [3]	NA	NA
Potassium (mg/L)	10.5	8 – 17 (12)	10 – 16 (12.6)	21 – 23 (22)	NA	NA	2 – 9 (6.9) [3]	NA	NA
Sodium (mg/L)	15.5	11 – 34 (17)	14 – 45 (22.4)	48 – 51 (49.5)	NA	NA	10 – 58 (20.4) [3]	NA	NA

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2016

Parameter	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2015) Ranges (Mean)*	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)[#]	Aquatic Ecosystems^ ~
Chloride (mg/L)	18	9 – 28 (18)	12 – 94 (31)	40 – 55 (47.5)	NA	NA	5 – 128 (31.8)[3]	NA	NA
Sulphate (mg/L)	4.5	1 – 13 (5)[3]	2 – 11 (6.2)[3]	23 – 28 (25.5)[3]	NA	NA	1- 27 (7)[3]	NA	NA
Cations (mg/L)	1.7	1.11 – 2.40 (1.71)[3]	1.43 – 4.78 (2.46)[3]	3.62 – 5.49 (4.55)[3]	NA	NA	1.38 – 3.45 (2.1)[3]	NA	NA
Anions (mg/L)	1.6	1.26 – 2.27 (1.74)[3]	1.27 – 4.64 (2.33)[3]	3.61 – 5.43 (4.52)[3]	NA	NA	1.38 – 6.65 (2.53)[3]	NA	NA
Arsenic (mg/L)	0.0035[3] (total)	0.001 – 0.007 (0.003)[3] (total)	0.003 – 0.007 (0.004)[3] (total)	0.008 – 0.026 (0.017)[3] (total)	NA	NA	0.002 – 0.005 (0.0028)[3] (total)	0.0026[3] (total)	0.008
	0.0015[3] (dissolved)	<0.001 – 0.004 (0.002)[3] (dissolved)	0.001 – 0.003 (0.002)[3] (dissolved)	0.002 – 0.006 (0.004)[3] (dissolved)	NA	NA	0.001 – 0.004 (0.0016)[3] (dissolved)	0.0016[3] (dissolved)	
Cadmium (mg/L)	<0.0001[3] (total)	<0.0001 - <0.001 (<0.0001)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.0001 - <0.001 (<0.0001)[3] (total)	NA	NA	0.0001 – 0.0001 (0.0001)[3] (total)	0.000055[3] (total)	0.0006
	<0.0001[3] dissolved)	<0.0001 – <0.0002 (<0.0001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	NA	NA	0.0001 – 0.0001 (0.0001)[3] (dissolved)	0.00005[3] (dissolved)	

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2016

Parameter	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2015) Ranges (Mean)*	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)[#]	Aquatic Ecosystems^ ~
Molybdenum (mg/L)	<0.001[3] (total)	0.001 – 0.004 (0.0015)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	NA	NA	0.001 – 0.001 (0.001)[3] (total)	NA	NA (insufficient data)
	<0.001[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	NA	NA	0.001 – 0.001 (0.001)[3] (dissolved)	NA	
Nickel (mg/L)	0.007[3] (total)	0.001 – 0.026 (0.008)[3] (total)	0.005 – 0.021 (0.011)[3] (total)	0.017 – 0.077 (0.047)[3] (total)	NA	NA	0.005 – 0.013 (0.0078)[3] (total)	NA	0.008
	0.002 – 0.003 (0.0025)[3] (dissolved)	0.002 – 0.005 (0.003)[3] (dissolved)	0.003 – 0.005 (0.004)[3] (dissolved)	0.004 – 0.004 (0.004)[3] (dissolved)	NA	NA	0.001 – 0.006 (0.0039)[3] (dissolved)	NA	
Lead (mg/L)	0.0035[3] (total)	<0.001 – 0.029 (0.006)[3] (total)	<0.001 – 0.021 (0.007)[3] (total)	0.007 – 0.097 (0.052)[3] (total)	NA	NA	0.001 – 0.006 (0.0029) (total)[3]	0.0029[3] (total)	0.001
	0.001[3] (dissolved)	<0.001 - 0.003 (0.002)[3] (dissolved)	<0.001 – 0.007 (0.002)[3] (dissolved)	<0.001 – 0.001 (0.001)[3] (dissolved)	NA	NA	0.001 – 0.002 (0.001)[3] (dissolved)	0.0005[3] (dissolved)	
Antimony (mg/L)	<0.001[3] (total)	<0.001 – 0.004 (0.002)[3] (total)	<0.001 - <0.001 (0.001)[3] (total)	<0.001 - <0.001 (<0.001)[3] (total)	NA	NA	0.001 – 0.001 (0.001)[3] (total)	NA	NA (insufficient data)
	<0.001[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	<0.001 - <0.001 (0.001)[3] (dissolved)	<0.001 - <0.001 (<0.001)[3] (dissolved)	NA	NA	0.001 – 0.001 (0.001)[3] (dissolved)	NA	

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2016

Parameter	Lake Inflow Water Quality Results (November 2010 – Mean[#])	Lake Inflow Water Quality Results (2011) Ranges (Mean)	Lake Inflow Water Quality Results (2012) Ranges (Mean)	Lake Inflow Water Quality Results (2013) Ranges (Mean)	Lake Inflow Water Quality Results (2014) Ranges (Mean)	Lake Inflow Water Quality Results (2015) Ranges (Mean)*	Lake Inflow Water Quality Results (2016) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)[#]	Aquatic Ecosystems^ ~
Zinc (mg/L)	0.015[3] (total)	<0.005 – 0.074 (0.0022)[3] (total)	0.009 – 0.051 (0.024)[3] (total)	0.033 – 0.234 (0.134)[3] (total)	NA	NA	0.007 – 0.027 (0.014)[3] (total)	0.012[3] (total)	0.0024
	0.03[3] (dissolved)	<0.005 – 0.219 (0.046)[3] (dissolved)	<0.005 – 0.068 (0.036)[3] (dissolved)	0.005 – 0.009 (0.007)[3] (dissolved)	NA	NA	0.005 – 0.008 (0.0055)[3] (dissolved)	0.00306[3] (dissolved)	

After: North Limited (1998).

^ Guideline values in accordance with ANZECC and ARMCANZ (2000).

~ 99% protection level trigger values for toxicants – lakes and reservoirs.

NA – Not Available.

[1] ANZECC and ARMCANZ (2000) notes that conductivity in lakes is generally low, but will vary depending upon catchment geology.

[2] ANZECC and ARMCANZ (2000) notes that lakes in catchments with highly dispersible soils will have high turbidity.

[3] Mean value.

Two readings only for December 2010.

* Lake Cowal was below 204.5 m RL during 2015.

Lake Cowal Inflow Water Quality

Lake Cowal inflow surface water monitoring sites were accessible on one occasion during the reporting period due to local and regional flooding restricting access. The surface water quality results from the lake inflow sites are summarised in Table 23.

The mean water quality results for the lake inflow sites in previous years have generally been similar to the water quality results recorded at the lake surface water monitoring sites. All mean heavy metal readings for 2016 were equal to or lower than the 2014 readings.

The mean results for dissolved heavy metals recorded at the inflow sites have previously been higher in comparison to the mean dissolved heavy metal results at the lake surface water monitoring sites. The mean results for total heavy metals recorded at the inflow sites are generally lower than or similar to the mean total results at the lake surface water monitoring sites.

Lake Cowal Sediments

A summary of the 2016 Lake Cowal sediment data is presented in Table 24. For consistency with the baseline data collected during 1991 – 1992 and the 2010 - 2014 reporting period results, the mean values of the parameters have been compared with the ANZECC and ARMCANZ (2000) default trigger levels.

Of the 34 lake sediment sample sites specified only 22 were able to be sampled in August 2016. Sites L4 to L13, I3, I4, B6, Sandy Creek, Bland Creek, Lachlan Inflow and Irrigation Inflow were too shallow to access safely at that time. In October 2016 all sites were able to be accessed by boat.

EC results ranged from 45 to 218 µS/cm with a mean of 105 µS/cm. These figures exclude an anomalous of 7,290 µS/cm at one of the sites, I1 in October 2016. A reading this high has not been previously recorded and if a similar reading is recorded in the future, further investigation will take place. The overall mean for the reporting period is lower than the 2014 means and similar to the 2010 level of 91 µS/cm. The ANZECC and ARMCANZ (2000) recommended guideline trigger values for sediments do not include a trigger value for EC however EC trends will continue to be monitored at Lake Cowal.

The mean heavy metals results during the reporting period were very similar to the mean heavy metals results for 2010 – 2014 with some minor variation noted. Mean heavy metals results were below the ANZECC and ARMCANZ (2000) sediment trigger values for extractable metals. All Total Antimony results were reported as <5mg/L (the laboratory detection limit), which is above the ANZECC and ARMCANZ (2000) sediment trigger value (2 mg/L). However, mean Antimony results are consistent with the 2010 – 2014 mean Antimony results.

7.2.3 Reportable Incidents

There were no reportable incidents during the reporting period.

7.2.4 Further Improvements

No further improvements were implemented during the reporting period.

Table 24: Summary of Lake Cowal Sediment Results

Parameter	Lake Cowal Sediment Results (November 2010)	Lake Cowal Sediment Results (2011) Range (Mean)	Lake Cowal Sediment Results (2012) Range (Mean)	Lake Cowal Sediment Results (2013) Range (Mean)	Lake Cowal Sediment Results (2014) Range (Mean)	Lake Cowal Sediment Results (2015) Range (Mean)*	Lake Cowal Sediment Results (2016) Range (Mean)	Aquatic Ecosystems^
Electrical Conductivity (µS/cm)	33 – 142 (94)	3 – 162 (99)	49 – 215 (94)	53 – 187 (105)	70 – 207 (133)	NA	45 – 218 (105)	No data
Arsenic (mg/L)	2.6 (total)	0.02 – 5.6 (3.1)[1] (total)	1 – 6 (3.2)[1] (total)	1.9 – 5.8 (3.2)[1] (total)	2.2 – 6.0 (3.62)[1] (total)	NA	1.6 – 5.8 (3.2)[1] (total)	20
	1.5 (extractable)	<0.1 – 1.8 (1.25)[1] (extractable)	1 – 3.1 (1.4)[1] (extractable)	1 – 3.1 (1.2)[1] (extractable)	1 – 2.2 (1.38)[1] (extractable)	NA	1 – 3.4 (1.7)[1] (extractable)	
Cadmium (mg/L)	1 (total)	<1 - <1 (1)[1] (total)	1 – 1 (1)[1] (total)	1 – 1 (1)[1] (total)	1 – 1 (1)[1] (total)	NA	1 – 1 (1)[1] (total)	1.5
	0.1 (extractable)	<0.1 - <0.1 (0.1)[1] (extractable)	0.1 – 0.1 (0.1)[1] (extractable)	0.1 -0.1 (0.1)[1] (extractable)	0.1 – 0.1 (0.1)[1] (extractable)	NA	0.1 – 0.1 (0.1)[1] (extractable)	
Lead (mg/L)	15 (total)	8 – 20 (13.7)[1] (total)	7 – 20 (12.6)[1] (total)	8 – 23 (14.2)[1] (total)	9 – 20 (13.53)[1] (total)	NA	5 – 18 (12.55)[1] (total)	50
	8.7 (extractable)	3.8 – 15 (8.8)[1] (extractable)	4.3 – 14.5 (8.6)[1] (extractable)	3.5 –13.3 (7.33)[1] (extractable)	5.3 -13.5 (8.51)[1] (extractable)	NA	3.5 – 14.8 (8.09)[1] (extractable)	
Zinc (mg/L)	31.5 (total)	14 – 57 (32.5)[1] (total)	11 – 43 (23.3)[1] (total)	13 – 63 (33.2)[1] (total)	16 – 100 (36.87)[1] (total)	NA	11 – 39 (25.86)[1] (total)	200
	3.5 (extractable)	1 - 14.8 (3.9)[1] (extractable)	1.1 – 7.7 (3.6)[1] (extractable)	1 – 11.4 (3.4)[1] (extractable)	3.3 – 52 (27.19)[1] (extractable)	NA	1.2 – 6.3 (2.83)[1] (extractable)	

Table 24 (Continued): Summary of Lake Cowal Sediment Results

Parameter	Lake Cowal Sediment Results (November 2010)	Lake Cowal Sediment Results (2011) Range (Mean)	Lake Cowal Sediment Results (2012) Range (Mean)	Lake Cowal Sediment Results (2013) Range (Mean)	Lake Cowal Sediment Results (2014) Range (Mean)	Lake Cowal Sediment Results (2015) Range (Mean)*	Lake Cowal Sediment Results (2016) Range (Mean)	Aquatic Ecosystems^
Antimony (mg/L)	5 (total)	<5 - <5 (5)[1] (total)	5 – 5 (5)[1] (total)	<5 - <5 (5)[1] (total)	<5 – <5 (5)[1] (total)	NA	5 – 5 (5)[1] (total)	2
	1 (extractable)	<1 – 6.9 (1.1)[1] (extractable)	1 – 7.6 (1.1)[1] (extractable)	1 - 4.8 (1.18)[1] (extractable)	1- 2 (1.03)[1] (extractable)	NA	1 – 2.2 (1.02)[1] (extractable)	

After: NSR Environmental Consultants (1995).

^ Guideline values in accordance with ANZECC and ARMCANZ (2000) recommended sediment quality guidelines.

[1] Mean value.

* Lake Cowal was below 204.5 m RL during 2015.

7.3 GROUNDWATER

The WMP and the SWGMBMP have been prepared in accordance with Development Consent Conditions 4.4(a) and 4.5(b) (and other relevant Development Consent Conditions) to guide water management and detail the CGO's water monitoring programme, respectively. The WMP and the SWGMBMP were approved on 19 November 2015.

Evolution also holds various licences for monitoring bores, open pit dewatering bores and CGO supply water/production bores.

Monitoring and management of groundwater during the reporting period has been undertaken in accordance with relevant Development Consent Conditions, the WMP, the SWGMBMP and the EPL 11912.

7.3.1 Environmental Management

7.3.1.1 Control Strategies

The WMP establishes the following objectives for the CGO site water management system including groundwater:

- Prevent the quality of any surface water (including waters within Lake Cowal) and groundwater being degraded, through the containment of all potentially contaminated water (contained water) generated within the CGO and diversion of all other water around the perimeter of the site.
- Manage the quantity of surface water and groundwater within and around the mine site through appropriate design (i.e. sizing), construction and operation of water management structures.
- Establish a monitoring, review and reporting programme that facilitates the identification of potential surface water and groundwater impacts and the development of ameliorative measures as necessary, including provision of appropriate compensation measures for landholders affected by changes to the flood regime of Nerang Cowal.

The review procedure relevant to groundwater monitoring detailed in the SWGMBMP provides:

> *Groundwater Monitoring: Groundwater quantity and quality data will be compared to relevant baseline data, data collected since the commencement of operations and assessment presented in the Project EIS. Where the data analysis indicates that an adverse impact is occurring to the efficiency of surrounding bores an investigation will be undertaken to determine the need and type of ameliorative measures. The scope and timeframe of the investigation will be developed in consultation with the relevant authorities. The results of the investigation will be presented to the relevant authorities and the CEMCC within the agreed timeframe.*

In order to monitor important background and predicted future water level draw-downs, monitoring bores and piezometers have been installed within ML 1535 and within aquifers potentially affected by the CGO (i.e. surrounding the BCPC Borefield and ESB) (Figures 9a and 9b).

In accordance with the SWGMBMP, groundwater monitoring includes:

- monitoring of bores in aquifers potentially affected by the CGO (drawdown levels); and
- feedback from private groundwater users regarding adverse changes in groundwater quantity.

7.3.1.2 Effectiveness of the Control Strategies

The control strategies implemented during the reporting period were considered to be effective as demonstrated by the environmental performance indicators.

7.3.1.3 Variations from Proposed Control Strategies

There were no variations from the control strategies during the reporting period.

7.3.2 Environmental Performance

7.3.2.1 Monitoring

During the reporting period groundwater monitoring was conducted in accordance with the SWGMBMP and EPL 11912. Groundwater monitoring locations within ML 1535 are shown in Figure 9a and regional groundwater monitoring locations shown on Figure 9b. The CGO water management system is outlined in Figure 10.

7.3.2.2 Performance Outcomes

A Groundwater Monitoring Review 2016 report has been prepared by Coffey Geotechnics (2017) which provides a detailed description and interpretation of the groundwater monitoring results during the reporting period.

Stiff plots of water quality results for the BCPC Borefield, processing plant area bores, pit area bores and TSF bores are provided in Figures 11a and 11b. Piper Plots of groundwater chemistry of the BCPC Borefield, processing plant area bores, pit area bores and TSF bores are provided on Figure 12. Deep and shallow groundwater contours are presented in Figures 13a and 13b.

Key summaries of the groundwater monitoring results presented in the Coffey Geotechnics (2017) report are provided in the subsections below.

Groundwater Levels

The Cowal groundwater system generally shows limited response to rainfall. The main groundwater level response is to pumping for water supply and pit dewatering. From 2004 to 2016, water supply pumping has resulted in a maximum drawdown of approximately 64 m in the BCPC borefield, and pit dewatering has resulted in a maximum drawdown of approximately 78 m in the pit area monitoring bores. In general, vertical hydraulic gradients within the groundwater system surrounding the mine pit are downward. Measured piezometric levels within the transported material tend to change more slowly than those for the Saprolite and Saprock.

Piezometric levels decline toward the pit with little reduction below the pre-mining level of approximately 200 m AHD at distances greater than approximately 2 km from the pit centre. Groundwater levels tend to be highest in the Transported material and lowest in the Saprock. The zone of influence after 11 years of mine dewatering is limited, indicating low lateral permeability.

A localised increase in groundwater levels has been observed in the vicinity of the TSF area. A separate groundwater level investigation was conducted by Coffey Geotechnics to further assess the change in groundwater level in this area (Coffey Geotechnics, 2009). A model of the groundwater system adjacent to the southern TSF was developed and calibrated to provide reasonable agreement with the measured groundwater levels in the area. It was concluded that increasing groundwater levels south of the southern TSF at bores MON02A and MON02B, and northeast of the southern TSF at P412A-R, are related to the movement of seepage from the TSF (Coffey Geotechnics, 2009). The direction of seepage flow towards the open pit is consistent with the seepage flow direction predicted in the EIS and in hydrogeological assessments. It was also assessed that groundwater level rises associated with the TSF are not expected to reach the ground surface (Coffey Geotechnics, 2009).

Standing water levels measured during the reporting period are presented in Figure 14.

Groundwater Quality

Physiochemical parameters pH and EC have generally remained stable for the groundwater data reviewed since mining operations began in 2004. ANZECC 2000 trigger values for pH range between 6.5 and 8 and are based on values for NSW upland rivers. Some pH results are below the ANZECC 2000 trigger value of pH 6.5. However, pH levels have generally remained stable, are slightly acidic to neutral, and are similar to baseline EIS levels. EC results have generally remained stable and are similar to, or higher than, the baseline EIS levels.

Trends in major ions have generally remained stable, though statistical analyses suggest slight increases in sodium concentrations for two of the seven BCPC bores (BLPR1 and BLPR2) and some of the monitoring bores surrounding the pit and TSF areas. In general, a broad trend of increasing sodium concentrations is seen between 2004 and 2010, beyond which sodium concentrations begin falling. This trend is stronger for the mine site than for the BCPC borefield, suggesting the cause may be related to severe drought conditions between 2004 and 2010. Groundwater with higher total dissolved solids, in high evaporation climates, is more prone to impact by drought conditions.

Mine site sulphate concentrations appear to show an inverse correlation with annual rainfall at Station 50017 (West Wyalong Airport), with increasing concentrations during sustained dry conditions. Sulphate concentrations fell in 2010, when about double the annual rainfall fell, compared to average annual rainfall since 2000.

Fluctuations in pH, EC, sodium, sulphate and iron levels at the BCPC borefield at bore BLPR2 may be related to bore completion or localised ground conditions, as the trend is not reproduced in other monitoring bores (Coffey Geotechnics, 2017).

Fluctuations in pH, EC, sodium, sulphate and bicarbonate levels at MON01B to the east of the NTSF may reflect a response to increased rainfall recharge over this period (Coffey Geotechnics, 2017).

Variations in metal concentrations are assessed to reflect the natural heterogeneity in ground conditions, rather than direct impacts from mining. Regional groundwater is located in a metalliferous geological terrain in which iron and manganese naturally dominate the metal concentrations. Local fluctuations in manganese and iron concentrations were evident in the pit area and this may be related to ground disturbance and proximity to the pit (Coffey Geotechnics, 2017).

During the 2016 reporting period, total and CN_{WAD} cyandide results were below the limits of reporting (Coffey Geotechnics, 2017).

The groundwater quality results and trends illustrate that the water management control measures for containment of mine site water and control of runoff from the TSF and waste rock emplacements appear to have prevented groundwater contamination (Coffey Geotechnics, 2017)**.**

7.3.3 Reportable Incidents

There were no reportable incidents during the reporting period.

7.3.4 Further Improvements

No further improvements were implemented during the reporting period.

8 REHABILITATION

Condition 2.4(c) of the Development Consent requires Evolution to prepare a Rehabilitation Management Plan (RMP). An RMP was prepared and submitted to the DRE for approval in 2015 however approval remained pending at the end of the reporting period.

As the RMP was not approved for the reporting period, the CGO was operated in accordance with the previously approved ROMP. In accordance with Development Consent Condition 2.4(c)(vii), the ROMP includes a rehabilitation monitoring programme that was developed to monitor the effectiveness of the short, medium and long-term mine site rehabilitation measures and progress against performance and completion criteria.

Monitoring and management of rehabilitation areas was undertaken during the reporting period in accordance with relevant conditions in the Development Consent, ML 1535, and the ROMP.

8.1 REHABILITATION OF DISTURBED LAND

The total active disturbance area was 1,095 ha at the end of the reporting period. Land being prepared for rehabilitation or under active rehabilitation was approximately 151 ha at the end of the reporting period and is expected to increase by approximately 8 ha during the next reporting period. There was no completed rehabilitation at the end of the reporting period.

A summary of rehabilitation undertaken at the CGO during the reporting period is described below:

- NWRE – North Wall – applied topsoil to 20 ha of the upper five batters on the western end and to the middle batters of the remainder;
- NWRE – North Wall – reshaped approximately 5 ha on the upper batters on the eastern end;
- NWRE – Planted 1500 tubestock within an approximately 7 ha area on the western end (over all 12 batters);
- SWRE – North Wall – reshaped approximately 6 ha and applied rock to approximately 4ha to the northern batter on the eastern end;
- SWRE – South Wall (rock – topsoil trial plots) ongoing monitoring of the direct seeding of November 2011;
- SWRE – South Wall – applied topsoil to the upper five lifts from the south western corner half way along the southern wall towards the east;
- SWRE – South-east Wall – reshaped the upper seven lifts east of the SWRE trial area further towards the east – approximately 5 ha; and
- Temporary Isolation Bund and Lake Protection Bund – road and weed maintenance.

Table 25 provides a summary of rehabilitation activities at the CGO during the reporting period. The table includes details of rehabilitation at the start of the reporting period and estimated for the next report.

Table 25: Rehabilitation Summary

		Area Affected/Rehabilitated (hectares)		
		Previous Reporting Period (2015)	**Current Reporting Period (2016)**	**Next Reporting Period (estimated) (2017)**
A	Total Mine Footprint	1,095	1,095	1,095
B	Total Active Disturbance	1,095	1,095	1,095
C	Land being prepared for Rehabilitation	196	151[#]	143
D	Land under active Rehabilitation	0	25	33
E	Completed Rehabilitation	0	0	0

Approximately 20 ha of land being prepared for rehabilitation was re-disturbed on the NTSF for buttress construction.

During the next reporting period, rehabilitation activities at the CGO will continue in accordance with the approved MOP and ROMP (or RMP if approved).

Table 26 provides details of the nature of disturbance, area and rehabilitation status for areas that have been disturbed up to and including the reporting period. Plate 3 shows the areas under rehabilitation as at December 2016.

Plate 3: Conceptual View of Rehabilitated Areas During the Reporting Period

All disturbed areas/structures had temporary erosion and sediment control measures implemented during construction in accordance with the ESCMP. Control measures included temporary sediment traps, sediment filters, diversion banks and silt fences. Further detail of erosion and sediment control measures for these areas/structures is described in the ESCMP.

No building renovations or removal occurred during the reporting period.

Table 26: Nature of Disturbance and Rehabilitation Status of Disturbed Land

Disturbed Area	Nature of Disturbance				Area (ha) (approximate)	Rehabilitation Status
	Vegetation Cleared	Topsoil and Subsoil Stripped	Earthworks	Construction Works Status*		
NTSF						
• Floor	✓	✓	✓	Complete	168	Not yet rehabilitated
• Starter embankment	✓	✓	✓	Complete	12	Shaped and covered
• Upstream lift	N/A	N/A	✓	Complete	8	Rock-topsoil cover
• Upstream lift	N/A	N/A	✓	Commenced	16	Not yet rehabilitated
STSF						
• Floor	✓	✓	✓	Complete	156	Not yet rehabilitated
• Downstream lift	✓	✓	✓	Complete	13	Shaped and covered
• Upstream lift	✓	✓	✓	Complete	24	Not yet rehabilitated
Open Pit	✓	✓	✓	Commenced	107	Not yet rehabilitated
PWE	✓	✓	✓	Commenced	60	All sections shaped and covered
NWRE (excluding outer batters)	✓	✓	✓	Commenced	240	Not yet rehabilitated
SWRE (excluding outer batters)	✓	✓	✓	Commenced	140	Southern section shaped
NWRE outer batters	✓	✓	✓	Commenced	55	Some sections shaped and covered
SWRE outer batters	✓	✓	✓	Commenced	31	Some sections shaped and covered
Ore Stockpiles	✓	✓	✓	Commenced	70	Not yet rehabilitated
Tailings service corridor	✓	✓	✓	Complete	5	Not yet rehabilitated
Soil stockpiles	✓	✓	✓	Commenced	125	Not yet rehabilitated
Processing plant (including contained water storages D5 and D6)	✓	✓	✓	Complete	20	Not yet rehabilitated
Mining Hardstand (including workshop and fuel farm)	✓	✓	✓	Complete	8	Not yet rehabilitated
Internal mine access road	✓	✓	✓	Complete	8	Not yet rehabilitated
Contained water storages D1 and D4	✓	✓	✓	Complete	5	Not yet rehabilitated
Contained water storages D2, D3 & D8B	✓	✓	✓	Complete	11	Not yet rehabilitated
Contained Water Storage D9	✓	✓	✓	Complete	13	Not yet rehabilitated

Table 26 (Continued): Nature of Disturbance and Rehabilitation Status of Disturbed Land

Disturbed Area	Nature of Disturbance				Area (ha) (approximate)	Rehabilitation Status
	Vegetation Cleared	Topsoil and Subsoil Stripped	Earthworks	Construction Works Status*		
Stilling basin and outfall	✓	✓	✓	Complete	1	Not yet rehabilitated
Temporary tank and holding pond for bore field water	✓	✓	✓	Complete	<1	Not yet rehabilitated
Mine dewatering bores	✓	N/A	✓	Complete	<1	Not yet rehabilitated
Minor internal roads and haul roads	✓	✓	✓	Commenced	40	Not yet rehabilitated
Temporary laydown areas	✓	✓	✓	Complete	1	Not yet rehabilitated
Exploration Geology office	✓	✓	✓	Complete	1	Not yet rehabilitated
Administration office	✓	✓	✓	Complete	1	Not yet rehabilitated
Temporary administration office	✓	✓	✓	Complete	1	Not yet rehabilitated
ML 1535 perimeter fence	✓	N/A	✓	Complete	<1	Not yet rehabilitated
Magazine compound	✓	✓	✓	Complete	2	Not yet rehabilitated
Temporary isolation bund	✓	✓	✓	Complete	10	Rehabilitated
Lake protection bund	✓	✓	✓	Complete	10	Rehabilitated
Up-catchment diversion system	✓	✓	✓	Complete	2	Rehabilitated and under maintenance
Internal catchment drainage system (permanent catchment divide)	✓	✓	✓	Complete	2	Rehabilitated and under maintenance
BCPC water supply pipeline	✓	✓	✓	Complete	2	Not yet rehabilitated
Saline groundwater supply borefield and associated pipeline	N/A	✓	✓	Commenced	10	Not yet rehabilitated
Boart Longyear office	✓	✓	✓	Complete	1	Not yet rehabilitated
Bioremediation area	✓	✓	✓	Complete	1	Not yet rehabilitated
Waste management yard	✓	✓	✓	Complete	1	Not yet rehabilitated
TSF construction compound	✓	✓	✓	Complete	2	Not yet rehabilitated

N/A: Not applicable.

* Construction works status refers to earthworks, excavations and/or emplacement of material.

The following text provides detail of the rehabilitation of each key final landform at the CGO that was undertaken during the reporting period.

Annual rehabilitation (and visual) monitoring of revegetated landforms is conducted to ensure vegetation is establishing and to determine the need for any maintenance and/or contingency measures (such as the requirement for supplementary plantings, erosion control and weed control). The rehabilitation works are subject to ongoing independent consultant review of effectiveness.

Progressive rehabilitation of each key final landform will continue to be undertaken in accordance with the *Cowal Gold Mine Extension Modification Environmental Assessment* (Barrick, 2013) and ROMP. Rehabilitation will continue to be undertaken to achieve final rehabilitation outcomes and other subsequent environmental approvals in accordance with the *Cowal Gold Mine Extension Modification Environmental Assessment* (Barrick, 2013).

Perimeter Waste Emplacement

The PWRE has been constructed to approximately 223 m RL and surrounds the pit to the north, east and south (Figure 3). The emplacement occupies an area of approximately 60 ha and forms part of the series of embankments (i.e. Temporary Isolation Bund and Lake Protection Bund) between the open pit and Lake Cowal. The emplacement elevation has been designed to reduce potential noise and light impacts of mining and processing on the surrounding environment and sensitive receptors.

Plate 1: North Side of Perimeter Waste Rock Emplacement

Northern Waste Rock Emplacement – Outer Batters

The NWRE is approved to be constructed to approximately 308 m AHD and will occupy an area of approximately 269 ha northwest of the pit (Plate 5).

An area of approximately 20 ha was topsoiled on the mid and upper slopes of the NWRE during the reporting period. The application of rock mulch on this area was generally not required as most of this waste emplacement consists of primary waste rock (the material used as rock mulch in the rehabilitation).

Tubestock planted within the D1 trial area to replace those lost after the initial planting in 2014, were watered and monitored during the reporting period.

Plate 2: North Side of Northern Waste Rock Emplacement (June 2016)

Southern Waste Rock Emplacement – Outer Batters

An area of approximately 6 ha on the northern wall of the SWRE (Plate 6) was topsoiled during the reporting period. Along the south wall, rock mulch was applied to the upper five batters and topsoil placed at the top of the SWRE (from ROM 6) ready for placement. Gypsum application and direct seeding were to be conducted but rehabilitation activities were postponed during the reporting period as high rainfall prevented access to the SWRE batters.

Plate 3: South Side of Southern Waste Rock Emplacement (June 2016)

Due to rain, some areas of the SWRE proposed for rehabilitation in the Cowal Gold Operations Mining Operations Plan (2014-2016) were unable to be completed. These areas are proposed for rehabilitation during the 2016-2018 MOP period.

Northern and Southern Tailings Storage Facility – Starter Embankments and Lifts

The TSFs are located 3.4km west of the Lake Cowal shoreline. Starter embankments have been progressively raised throughout the mine life with tailings disposal alternating between each facility.

No rehabilitation occurred on the NTSF and the STSF during the reporting period due to the requirement for buttressing on subsequent lifts in future years (i.e. active landforms). The outer face of the lift was constructed with primary waste rock and therefore will be protected from erosion.

The long-term rehabilitation objectives for the tailings storage facilities include the re-establishment of woodland communities and will commence following the cessation of tailings deposition.

Any emergent deeper rooted species that germinate in the walls of the TSF structures continued to be poisoned by stump paste with glyphosate. As per ongoing TSF fauna protection practices, no trees shall be encouraged to grow until after the final capping is completed on the TSFs.

Boundary Amenity Plantings

Inspections of the vegetation screening surrounding the CGO identified that no additional tubestock was required to be planted during the reporting period.

8.2 REHABILITATION MONITORING RESULTS

Monitoring within the active rehabilitation areas was undertaken by DnA Environmental (2017a) during the reporting period. A summary of the results from this monitoring survey are outlined below. The indicative location of soil stockpiles and the location of rehabilitation, offset and RVEP monitoring sites are presented on Figures 15 and 16, respectively.

8.2.1 Waste Rock Emplacement Monitoring Results

The waste rock emplacement rehabilitation sites NWRE01, PWRE01 and SWRE01 were in their early developmental stages in 2014 but have undergone significant transformation over the past two years, largely due to the voluntary establishment of *Lolium rigidum* (Wimmera Ryegrass). Due to the increase in protective litter cover there has been an increase in surface crusting and there was less evidence of resources being mobilised across the sites.

This year NWRE01, PWRE01 and SWRE01 had all further increased in stability as the soils become harder and slightly more coherent and cryptogams were relatively abundant. Native species were more diverse than exotic species in the 20 x 50m monitoring quadrat in all sites except NWRE03, NWRE04 and SWRE01. In several sites on the waste rock emplacements there has been some volunteer recruitment of *Maireana brevifolia* (Yanga Bush), *Glycyrrhiza acanthocarpa* (Native liquorice) and/or *Muehlenbeckia florulenta* (Lignum) from the soil seed bank.

In NWRE03 there were a total of 42 native shrubs and juvenile trees which had been planted as tubestock in October during 2016. Despite only 51% tubestock survival being recorded in NWRE03, it presently contained an adequate density of trees and juvenile shrubs compared to the hill reference sites. No shrubs or juvenile trees were recorded in NWRE04 or SWRE01.

In the waste rock emplacements the soils were slightly to strongly alkaline, slightly to moderately saline and sodic. They were deficient in OM, N and in NWRE01, NWRE04, PWRE01 and SWRE01 P was too low. In the NWRE and PWRE there has been a significant decline in EC over the past two years, perhaps due to oxidation and leaching, but the soils remained above the agricultural threshold and were slightly to moderately saline. In 2015 the Exchangeable Sodium Percentage (ESP) had escalated in NWRE and SWRE with the soils being highly sodic. In NWRE01 and PWRE01 however, there has been a dramatic reduction in ESP with the soils within the non sodic classification this year.

The waste rock emplacements also had particularly high concentrations of sulfur (S) and in NWRE they were up to 60 times higher than the recommended guidelines which may have some implications for the development of these rehabilitation areas.

The data indicate there have been significant ecological and chemical changes occurring within the rehabilitation areas largely as a result of the colonisation of *Lolium rigidum* which has essentially provided a thick mulch cover across much of the rehabilitation areas. While the extensive voluntary establishment of *Lolium* from the soil seed bank has provided significant ecological stability and function of some of the rehabilitation areas, the high competition effects on the forthcoming tubestock and/or native seed mixes and the colonisation other desirable native ground covers remains unknown, however there seems to be an increasing abundance of native ground covers within the older rehabilitation areas. Management intervention may be required in the early establishment phases so that native trees, shrubs and ground covers similar to the local hill and ridges can become well established. The establishment from seed is a preferred option to tubestock planting over the large rehabilitation areas.

8.2.2 Rehabilitation Trial Monitoring Results

Northern Waste Rock Emplacement Rehabilitation Trial

The NWRE rehabilitation trial (Plate 7) aims to further assess the effectiveness of a variety of rehabilitation treatments or combination of treatments known to improve rehabilitation objectives in a replicated experimental design. The design has incorporated “standard” rehabilitation procedures such as a rock mulch underlay, topsoil and gypsum application which have proven to be essential components in the rehabilitation of saline, sodic and dispersive top soils and the extreme climatic conditions of the semi-arid Lake Cowal environment. These rehabilitation trials aim to determine if adequate rehabilitation outcomes can be obtained by reducing the depth of topsoil from the recommended 300 mm application whilst achieving a selection of primary ecological completion targets.

Plate 4: NWRE – Pond D1 North Trial Tubestock (April 2016)

Monitoring of these trials is consistent with that used for the annual ecological programs being implemented at the CGO. A range of ecological performance targets from the trial treatments are compared to those measured within reference sites of woodlands occurring on ridges and hills and lower foot slopes. A selection of critical performance indicators provide the benchmark for rehabilitation success and therefore comprise the completion criteria required for mine closure and are consistent with the new ESG3 MOP guidelines (DRE, 2013).

Due to the various issues associated with the implementation of the rehabilitation trial, there ended up being two main experiments. The first was undertaken during 2012/2013 with the second implemented late in 2014. There have also been numerous variations to the original experimental design with difficulties in the timing and applying uniformity (eg. soil, pasture hay, plot size, tubestock species, mortality, density) thus there was high variability within the experimental treatments. Further variability associated with the hand watering of the tubestock is also expected, therefore the results should be treated with some consideration.

In the older trial (2012/2013) sites, there was no significant difference in Landscape Organisation as a result of the different depths of topsoils with all sites having 100% functional patch area this year. Sites that did not have an application of straw also proved to have a high functional patch area at 150 and 300 mm topsoil depths due to the voluntary establishment of *Lolium rigidum* which significantly increased in abundance over the past few years. In the 2014 trial areas the highest LOI's were recorded in the Native Pasture Hay and Straw mulch plots. Sites without a cover of mulch had significantly lower patch areas however these patch areas have also increased as a result of the volunteer establishment of *Lolium rigidum* over the past year.

While there was little conclusive evidence about the effects of mulch type used or depth of topsoil on the short term survival of native tubestock, mortality and survival may be more closely implicated with a range of other variables. Some other variables affecting tubestock survival may include:

- Planting time and coincidence with optimum rainfall event (differences between year of trials);
- Planting position (trough vs. bank etc);
- Planting techniques (differences between planting personnel);
- Competition from other ground covers (especially *Lolium rigidum* during spring when it is actively growing and moisture becomes limiting);
- Variability in watering regimes (different techniques between individuals/areas);
- Effectiveness of supplementary watering (frequency, volume, infiltration, erosion around roots etc);
- Soil chemistry (these are known to be patchy within and across the trial areas. Poor soil chemistry in 200mm topsoil area); and
- Herbivory (this has not yet been observed to have affected the tubestock).

It still appears too early to tell which depth of topsoil and mulch application is more conducive to a produce a functional and diverse woodland community which is representative of the hills and ridges of the Lake Cowal area. This is likely to become more apparent with the growth and development of the planted trees and shrubs which will have a significant influence on the composition and diversity of the sites especially when they become mature and provide an overstorey canopy. In addition, many native perennial grasses and other ground covers are becoming increasingly more abundant.

There were significant differences in soil characteristics between the two main trial areas as well as within replicated treatments, with numerous attributes being quite different to the Hill reference sites. Many of these soils characteristics however were similar to soils analyses obtained from sites in ‘woodlands occurring on flat to gently undulating slopes’ (Slopes reference sites), communities from which the topsoil in the trials was originally derived. Many undesirable attributes such as high EC and sulfur have demonstrated a dramatic reduction over two years, and while many of these continue to exceed recommended concentrations, it could be possible that these will continue to decline over time such that more acceptable levels are reached. This effect was demonstrated in several of the trial treatments in the older 2012/2013 trial area this year.

Investigations into the depth of the roots of the planted tubestock (see accompanying report) have indicated that the roots (and subsequent tree growth) is not particularly influenced by the depth of the topsoil. Rather it appeared that the underlying hard and compacted oxide layer was providing a physical (rather than a chemical) barrier resulting in the tree and shrubs roots growing laterally on top of this oxide layer. This may have implications for the health and longevity of the trees during prolonged dry conditions in the longer term.

These trials will be continued during the next reporting period.

9 COMMUNITY RELATIONS

Evolution recognises developing and maintaining a positive relationship with the local community is essential to running a successful mining operation. Evolution has developed a "Community Relations Policy" designed to support the Evolution vision to:

> "*…be the world's best gold mining company by operating in a safe, profitable and responsible manner.*"

Evolution strives to earn the trust of all with whom we interact, whether they be our employees, the communities where we live and work, the governments that host us, or other stakeholders with whom we engage in the sustainable development of mineral resources. The Community Relations Policy guides Evolution in its conduct of business around the world, including at the Cowal Gold Mine.

9.1 COMMUNITY COMPLAINTS

The Development Consent and EPL 11912 require implementation of a complaints mechanism. A community complaints line was established on 9 December 2003 and operates 24 hours per day. Complaints and/or concerns can be made by dialling (02) 6975 3454 where an operator advises the caller that they have reached the CGO Complaints Line. Details of the Complaints Hotline are also advertised quarterly in the following local newspapers; The West Wyalong Advocate, The Forbes Advocate, The Condobolin Argus, and The Lachlander. Finally, the Complaints Hotline is advertised within the Cowal Update community newsletter, released by Evolution and distributed to all households within West Wyalong, Forbes, and Condobolin and via the aforementioned local newspapers as inserts.

When a call is made to the Complaints Hotline, the operator requests the caller's name, the nature of their complaint/concern, and a return phone number. The information is logged along with the date and time that the call was made. A record of each call is immediately forwarded to the CGO Community Relations Department via the community.cowal@evolutionmining.com.au email. For immediate notification of complaints logged outside of regular business hours, the Community Relations receives a copy of the notice to their assigned mobile phone. Upon receiving an enquiry, the Community Relations Manager conducts necessary investigations and prepares a response. The caller is contacted within 24 hours of the complaint, to gather further information and notify of any action taken or proposed by Cowal Gold Mine.

Complaints may also be submitted through regular stakeholder interactions that may occur between CGO personnel and community members from time to time. All employees and contractors receive information about the CGO's Complaints Management Process during General Induction.

A summary of the community complaints received during the reporting period (as required by the Development Consent) is provided in Table 27.

Table 27: Summary of Community Complaints during the Reporting Period

DETAILS	Resident of Lake Cowal, (Complainant A)
COMPLAINT / CONCERN	Resident of Lake Cowal – called the CGO Community Complaints and Enquiry Number reporting shaking of his house at the approximate time of the blast in the Pit.
DATE and TIME	13/07/16 – 12:34pm
OUTCOME	Wednesday 13/07/16 1. Senior Environment Advisor contacted Complainant A and told him he would speak to the Mining Department and analyse the data to see if anything abnormal or non-compliant had occurred. 2. Senior Environment Advisor contacted Saros Consultants to conduct an investigation into the blasting impacts on BM08.1. Data would not be available until 6pm 13/07/2016 Thursday 14/07/2016 3. Senior Environment Advisor met with Complainant A at their home to discuss the complaint (13/07/2016) regarding our blasting activities and they described what had happen. Complainant A described how his son was outside and heard a loud crack and felt the ground shake, while Complainant A felt the walls shake. 4. Senior Environment advisor discussed the results of the Saros investigation which indicated that: • The Nearfield / Mine Bund monitor (BM10) did record higher levels of overpressure at 128.4 dB(L) but there was no significant vibration associated with the blast. • No vibration was recorded at BM8.1 monitor and overpressure levels at the time of blasting were only 101.0 dB(L). • No significant levels were picked up at the Southern Bird Breeding (BM05) monitor which is between the pit and Cowal North (BM08.1), or at the Northern Bird Breeding (BM04.1) monitor. 5. Senior Environment Advisor was present at the Complainants home when a blast event occurred at CGO which was faintly heard but there was no vibration or overpressure impacts felt at the house. 6. Complainant A asked if there would be any compensation if things got bad regarding the blasting activities. The Senior Environment Advisor suggested ongoing monitoring of the data and explore if there is any correlation between past complaints and weather conditions, as the monitoring data does not indicate a significant impact. 7. Complainant A was generally happy with this response and the Senior Environment Advisor offered to come back to Cowal North if similar blasting and weather conditions present themselves.
DATE OF RESPONSE	13/07/16

Table 27 (Continued): Summary of Community Complaints during the Reporting Period

DETAILS	Resident of Lake Cowal, (Complainant A)
COMPLAINT / CONCERN	Blasting
DATE and TIME	**24/10/2016 – 12:30pm**
OUTCOME	1. The Complainant called the CGO Senior Environmental Advisor (SEA) to say that they had just felt the blast at their home and it had given the house "a fair old shake". The SEA asked if he had felt any other blast recently and he informed him that they have not been at the house very often since the flood waters surrounded their house. SEA made the commitment that he would conduct an investigation and get the results back to Complainant A shortly. 2. SEA requested a review of the blast data from external blasting consultants and called Mining Superintendent to find out the details of the blast. 25/10/2016 3. Preliminary blast results were received from external consultants indicated that the blast was within compliance limits (105.5 dB(L)). When compared with historical data, results indicated that the overpressure was not attenuating at the same rate as when Lake Cowal is dry. 4. SEA tried to call Complainant A on two occasions and left a message on his mobile phone. SEA received a missed call from Complainant A at 20:18 on the 25/10/2016. 26/10/2016 5. SEA spoke to Complainant A at 14:52 and stated that the investigation indicated that the blast was within compliance limits but the water in Lake Cowal was having an effect on how the overpressure attenuates over distance. SEA encouraged Complainant A to continue to report blasting impacts and if CGO identify particular weather conditions or blasting practices that are exacerbating the problem then it would assist in the management of blasting. 6. The SEA emailed a copy of the blasting investigation to Complainant A.
DATE OF RESPONSE	26/10/16
DETAILS	Business Owner at West Wyalong
COMPLAINT / CONCERN	Employee Behaviour
DATE and TIME	**31/10/2016 – 7:00am**
OUTCOME	1. CGO employee informed the Senior Social Responsibility Advisor that the owner of a local business had complained to him about CGO employees using his car park during the day and limiting access for customers. 2. The Senior Social Responsibility Advisor visited the business to speak to the owner about the issue. The owner stated that a small number of CGO employees were parking in areas designated for his customers, and that it was impacting his business. The Senior Social Responsibility Advisor and the owner walked around the area to identify other suitable parking areas that would not impact his business. Contact details were provided to the business owner for any future concerns. 3. A site wide email was sent out to all employees indicating designated parking areas, and reminding employees the process for reporting community complaints and feedback.
DATE OF RESPONSE	31/10/2016

Table 27 (Continued): Summary of Community Complaints during the Reporting Period

DETAILS	Business Owner at West Wyalong
COMPLAINT / CONCERN	Employee Behaviour
DATE and TIME	**9/11/2016 – 2:00pm**
OUTCOME	9/11/2016 1. The Complainant called the Cowal Community hotline about a CGO employee that had parked their car blocking deliveries and preventing the business from accessing garbage bins. 2. The Senior Social Responsibility Advisor visited the business, spoke to the owner and proceeded to wait for the owner of the vehicle. 3. The CGO employee was identified and spoken to regarding appropriate parking locations at the rear of the business.
DATE OF RESPONSE	9/11/2016

9.2 COMMUNITY LIAISON

Community Environmental Monitoring and Consultative Committee

During the reporting period, quarterly meetings of the CEMCC were conducted in accordance with the Development Consent.

The CEMCC was established prior to commencement of construction works, in accordance with the Development Consent requirements. The CEMCC monitors compliance with conditions of the Development Consent and other matters relevant to the operation of the mine.

The CEMCC meets on-site or in local communities, undertakes regular inspections, reviews environmental and audit reports and discusses any incidents or complaints that may have been registered. The CEMCC members are an active conduit between local communities and the CGO. Minutes are taken from each meeting and published in the local library and also on the BSC website. The Minutes of the CEMCC are published on the Cowal Gold Mine website (http://www.evolutionmining.com.au/cowal/).

Community Consultation

The “Cowal Update” is the CGO community newsletter that is distributed to all households in West Wyalong, Condobolin, and Forbes, and via insert within the four local newspapers covering the Bland, Lachlan and Forbes Shires. The release of the 2016 Cowal Update was delayed due to the flooding of Lake Cowal and was released in January 2017. The next Cowal Update is due to be published in July 2017.

Evolution extended invitations to numerous community groups to visit the CGO for presentations and site visits. Site visits were undertaken by a number of groups during the reporting period including:

- Bland, Forbes and Lachlan Shire Councils;
- various community and charity groups from neighbouring towns and villages; and
- various primary and secondary schools.

Community and Family visit days are conducted annually with up to 600 people in attendance over the two days. The Community and Family days were cancelled in 2016 due to the flooding of Lake Cowal. The next Community and Family days are scheduled for October 2017.

In addition, the Cowal Gold Mine regularly hosts school and community group visits. Stakeholder meetings are carried out on-site or in the local community depending upon the group and topic. These meetings can consist of 3 to 20 people, for example:

- CEMCC meetings (which are held quarterly).
- Local landholders and local community and charitable groups.
- Local Government and State agency meetings.

Evolution also attended several off-site presentations involving the community including:

- local community and charitable groups;
- Wiradjuri Condobolin Corporation
- Lachlan, Bland and Forbes Shire Councils; and
- Local secondary schools.

Indigenous Consultation

Evolution continued to work with the Wiradjuri Community through the Wiradjuri Condobolin Corporation and a number of formal committees, including:

- the Cowal Project Coordinating Committee; and
- the Employment, Training and Business Committee, which meets with the Wiradjuri Condobolin Corporation on a regular basis.

Community Development

Evolution continued to support numerous donation, sponsorships and partnerships to a variety of local schools, annual events, charity and not for profit groups, community infrastructure and town advancement groups.

Evolution operated the Cowal Partnering Program, the Cowal Cares Program, the Shared Value Projects and the Endeavour and Wiradjuri Scholarship program to facilitate financial contributions to the community during the reporting period.

The Lake Cowal Foundation Limited

The Lake Cowal Foundation (LCF) continues to grow into an important local independent “Environmental Trust”. The Foundation is actively supported financially and in-kind by CGO. The LCF Board meet as required, some meetings are held via teleconference.

In addition to housing the LCCC on Evolution-owned property ‘Hillgrove’, Evolution has also provided the LCF with considerable freehold property to undertake conservation and research projects. Evolution also provides secretariat services to the LCF.

The LCF has now been involved in approximately 32 conservation projects in the Lake Cowal region and has developed a relationship with 34 project partners, including:

- numerous local land owners and managers;
- Riverina and Central West Local Lands Services;
- EPA, National Landcare Program, Natural Heritage Trust, Environmental Trust, Greening Australia and DPI (Fisheries);
- Forbes, Lachlan, Weddin, Temora and Bland Shire Councils, and the Central-west and Riverina Local Land Services;
- Charles Sturt University, CSIRO, Western Research Institute, Western Institute of TAFE and West Wyalong High School; and

- numerous local bodies such as the West Wyalong Anglers and Gardening Clubs.

Some of the projects that the LCF have completed or are involved in include:

- the restocking of Bland and Sandy Creeks with native fingerlings;
- Lake Cowal and Bland Creek revegetation projects;
- Bland Creek Catchment Incentives Grants Project that has combined contributions of approximately $5 million;
- a Natural Sequence Farming project which aims to reconnect the hydrologic function of the 10 km Spring Creek with its floodplain;
- collaborative research with CSIRO Plant Industry into native grassland population dynamics;
- Pasture Re-establishment Trials and Pasture Cropping Trials;
- the LCCC; and
- seed collection, assessment of remnant vegetation and establishment of a herbarium.

The LCF continues to be an important organisation with conservation, pastoral, community, government, educational and mining groups working collaboratively together to achieve considerable outcomes for the Lake Cowal region.

10 INDEPENDENT ENVIRONMENTAL AUDIT

An IEA of the CGO was conducted between the 26 and 29 April 2016 by Trevor Brown and Robert Drury of Trevor Brown & Associates, Michael Frankcombe of WPS Parsons Brinkerhoff (Rehabilitation) and Mathew Richardson of Niche Environmental (Ecology and Biodiversity), to assess the compliance status of the CGO, in accordance with Consolidated Development Consent 14/98 condition 9.2(a). The IEA reviewed the status of compliance of the CGO between May 2013 to April 2016.

The audit was undertaken generally in accordance with the Australian/New Zealand Standards AS/NZS ISO 19011:2014 - Guidelines for Auditing Management Systems and the Independent Audit Guideline (NSW Government, 2015). The documentation and files held at the CGO site and interviews/discussions with relevant site personnel, provided the auditors with the required information for verification of compliance of the CGO with Development Consent 14/98 and other statutory environmental approvals.

The CGO has been developed generally in accordance with the environmental assessments prepared for project and the audit findings confirm an overall high standard of compliance with the Development Consent conditions, EPL 11912 and requirements of the environmental conditions attached to ML 1535. Recommendations and observations from the IEA are discussed in Table 28. The next Triannual Independent Environmental Audit is scheduled for May 2019.

Table 28: Recommendations and Observations from the 2016 Independent Environmental Audit

Recommendation / Observations	Action status
It is recommended that consideration should be given to controlling overabundant macropod numbers on the revegetation enhancement site at Fellman's Hill to encourage new plant growth and maintain species diversity".	Approximately 200 Eastern Grey kangaroos were tagged and culled during the reporting period on Felman's Hill area (RVEP1).
Monitor rehabilitated areas of the waste rock emplacements for evidence of tunnel erosion (inlets and outlets) following rain events. If there is evidence of tunnel erosion, consider undertaking soil characterisation and erosion and landform evolution modelling to verify the current landform design or to develop an amended landform design. Soil characterisation and landform evolution modelling using WEPP and SIBERIA has demonstrated that free draining concave landforms are often more appropriate for dispersive mine soils than traditional benched landforms that encourage water ponding on slopes. It is relatively cost effective process to characterise site soils and undertake erosion and landform evolution modelling compared with the cost of remediation works should tunnels form.	Waste rock emplacements continue to be periodically and regularly monitored for erosion. Observations from the DNA Rehabilitation Monitoring Report incidated the current landform design is successful in limiting erosion on the waste rock emplacements.
Incorporate Gypsum into the site soil prior to capping with rock and topsoil. The risk of tunnel erosion can be reduced by incorporating sufficient Gypsum into the soil to reduce the Exchangeable Sodium Percentage to less than 6. Gypsum has very low solubility and must be incorporated into the soil (mixed) to be effective. Current site practice is to spread Gypsum over the subsoil prior to the placement of waste rock and topsoil. The Gypsum should be mixed into the soil via contour ripping to a depth of 0.5 m.	McKenzie Soil Management Pty Ltd conducted a Soil Stockpile Characterisation Assessment in 2013 to determined ameloration strategies and gypsum application rates for the dispersive soils at CGO. The recommendations of the McKenzie soil assessment, including the application of gypsum, were implemented during the reporting period.
Ensure the design of any future void cut backs create gradients suitable for the incorporation of Gypsum into the dispersive subsoils or allows capping with suitable non-dispersive material. The gradient of the upper sections of the void walls are too steep to allow either ripping of Gypsum into the soil to reduce the Exchangeable Sodium Percentage to less than 6 or to cap the exposed dispersive soil with suitable non-dispersive material. It is understood that future cut backs of the pit are being considered. This would be the appropriate time to modify the design to mitigate the dispersion. If left untreated it is possible that tunnels could extend into the Lake Protection Bund. It is recommended that advice be sought from an experienced soil scientist in this regard.	Erosion modelling of the upper sections of the void walls is planned for the next reporting period to understand the risk of tunnel erosion and identify rehabilitation strategies.

11 INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD

No reportable incidents or non-compliances occurred during the reporting period.

Summaries of any incidents during the reporting period have been described in the ‘Reportable Incidents’ sections throughout this AR.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Summaries of the activities to be completed in the next reporting period have been described in the 'Further Improvements' sections included throughout this AR.

13 REFERENCES

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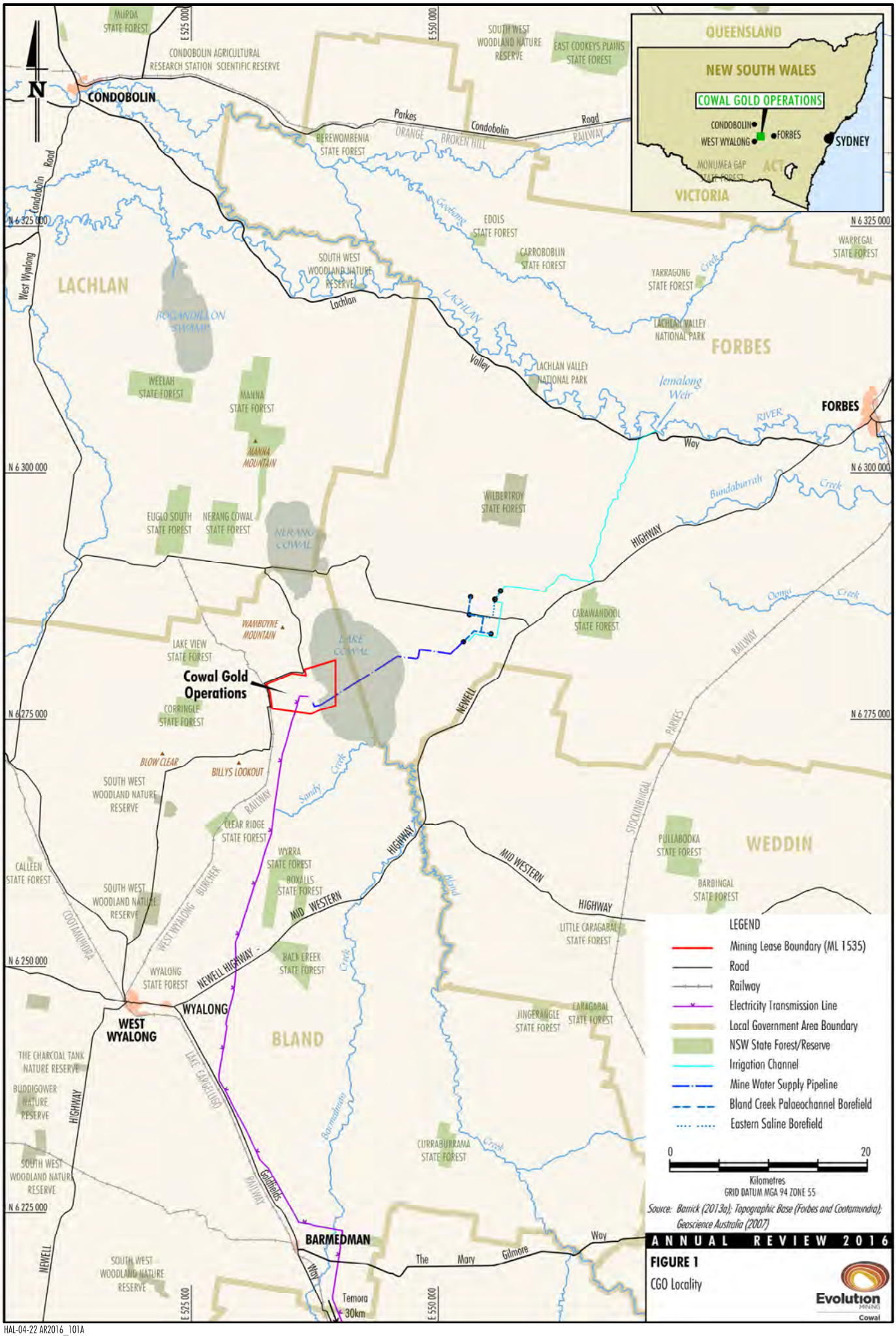
GLOSSARY OF TERMS

AR	Annual Review
ANZECC	Australian New Zealand Environmental Conservation Council
ARD	Acid Rock Drainage
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AWS	Automatic Weather Station
BCPC	Bland Creek Paleochannel
BLMP	Blast Management Plan
BOMP	Biodiversity Offset Management Plan
BSC	Bland Shire Council
CEMCC	Community Environmental Monitoring & Consultative Committee
CGO	Cowal Gold Operations
CMP	Cyanide Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CW	Compensatory Wetland
CWMP	Compensatory Wetland Management Plan
DP&I	Department of Planning and Infrastructure
DP&E	Department of Planning and Environment
DECCW	Department of Environment, Climate Change and Water (now EPA)
DPI	Department of Primary Industries
DRE	Department of Resources and Energy
DRG	Division of Resources and Geoscience
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EPA	Environment Protection Authority
EPL	Environment Protection License
ESB	Eastern Saline Borefield
ESCMP	Erosion and Sediment Control Management Plan
ETBC	Employment Training Business Council (WCC – Evolution)
Evolution	Evolution Mining (Cowal) Pty Limited
FFMP	Flora and Fauna Management Plan
HMP	Heritage Management Plan
HWCMP	Hazardous Waste and Chemical Management Plan
IACHMP	Indigenous Archaeology and Cultural Heritage Management Plan
IEA	Independent Environmental Audit
LMP	Land Management Plan
ML	Mining Lease
MOP	Mining Operations Plan
NPWS	National Park and Wildlife Service
NTSF	Northern Tailings Storage Facility
NWRE	Northern Waste Rock Emplacement
OEH	Office of Environment and Heritage
PWRE	Perimeter Waste Rock Emplacement
RL	Relative Level metres
RMP	Rehabilitation Management PLln
ROMP	Rehabilitation and Offset Management Plan
RVEP	Remanant Revegetation Enhancement Programme
STSF	Southern Tailings Storage Facility
SWRE	Southern Waste Rock Emplacement
SWGMBMP	Surface Water, Groundwater, Meteorological and Biological Monitoring Programme
TSF	Tailings Storage Facility
TSMP	Threatened Species Management Protocol
TSMS	Threatened Species Management Strategy
TSP	Total Suspended Particulates
WAD	Weak Acid Dissociated
WIRES	Wildlife Information Rescue and Education Service
WMP	Water Management Plan

FIGURES



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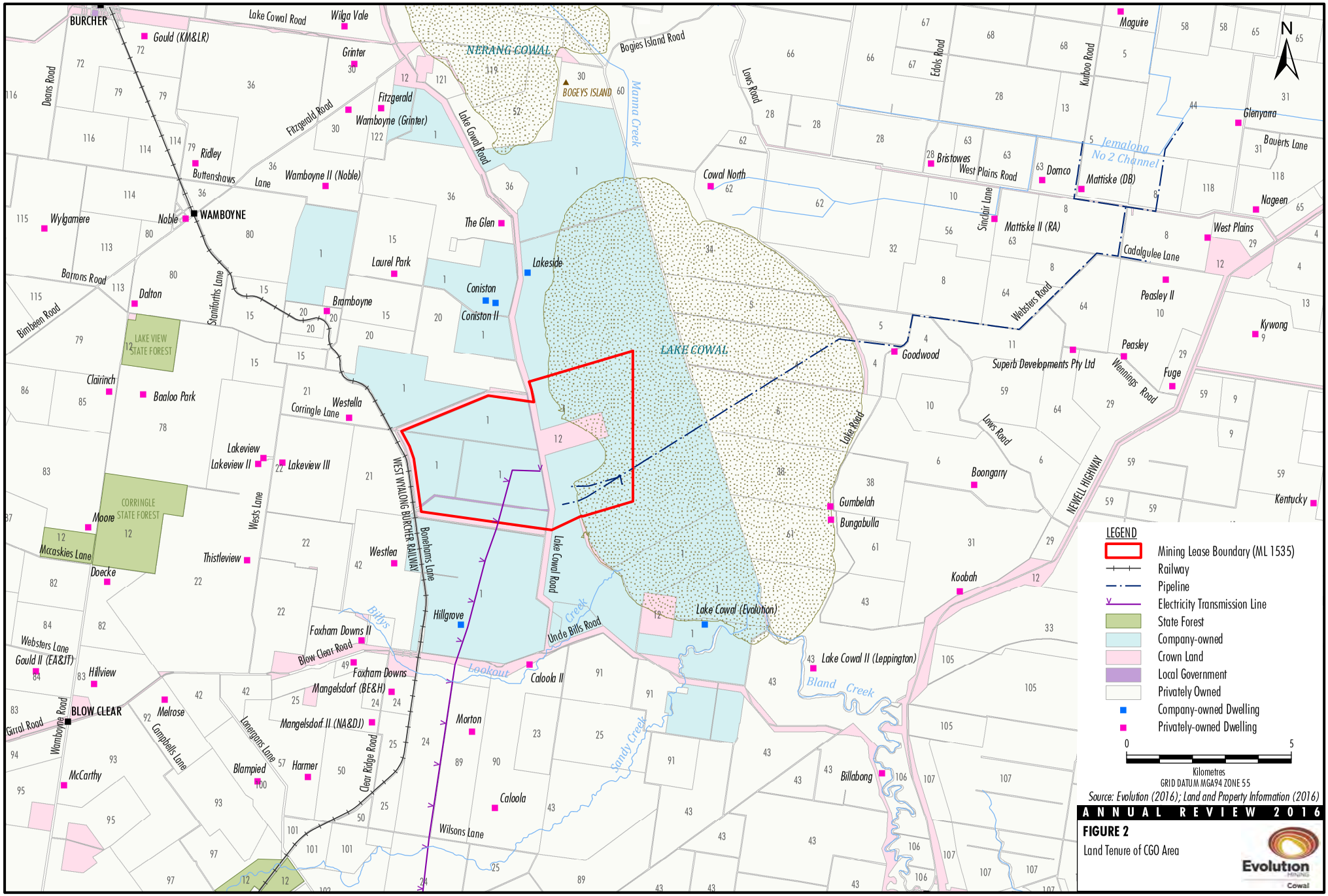

Source: Evolution (2016); Land and Property Information (2016)

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FIGURE 2

Land Tenure of CGO Area

Evolution MINING Cowal

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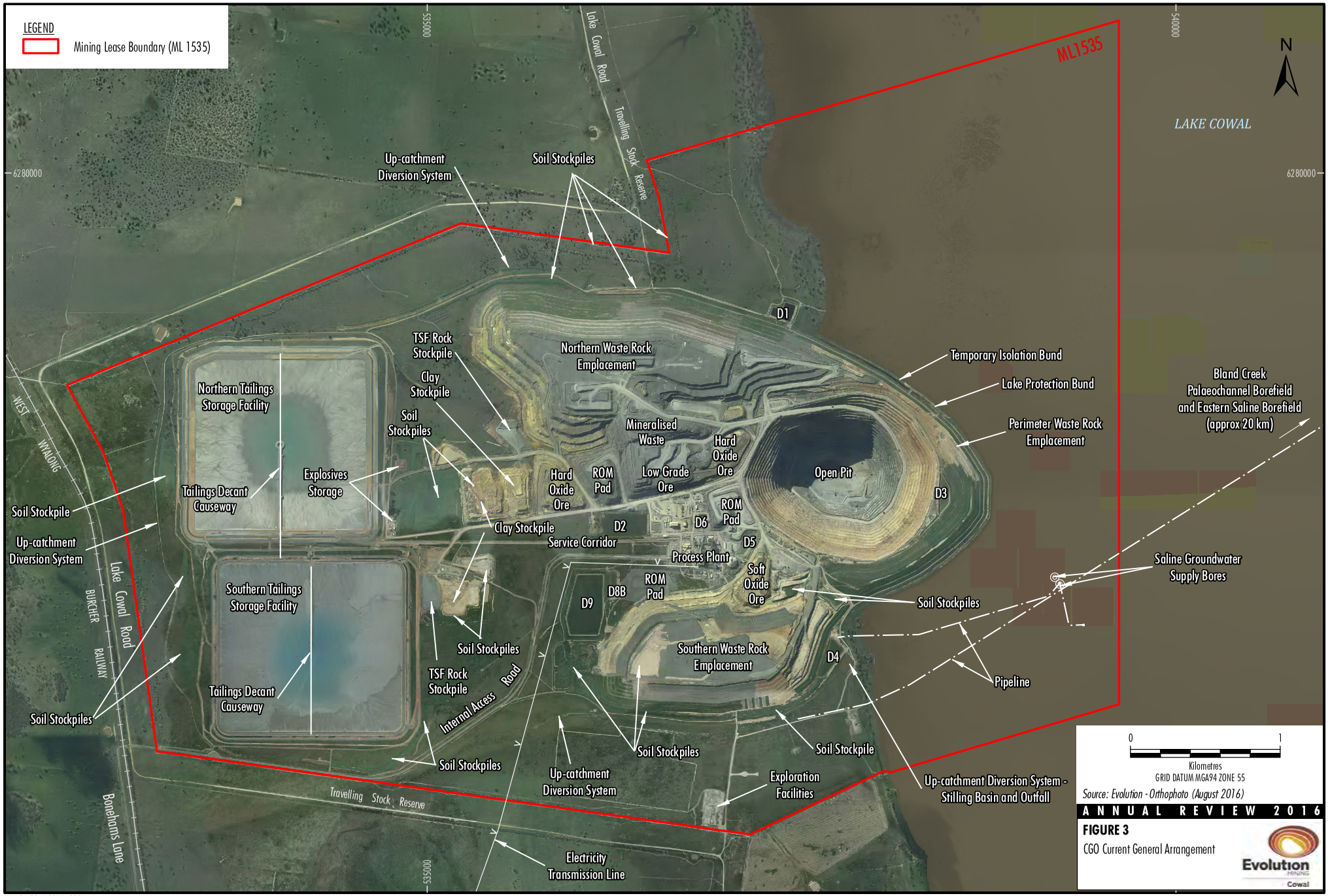

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FIGURE 3

CGO Current General Arrangement

HAL-04-22 AR2016_205A

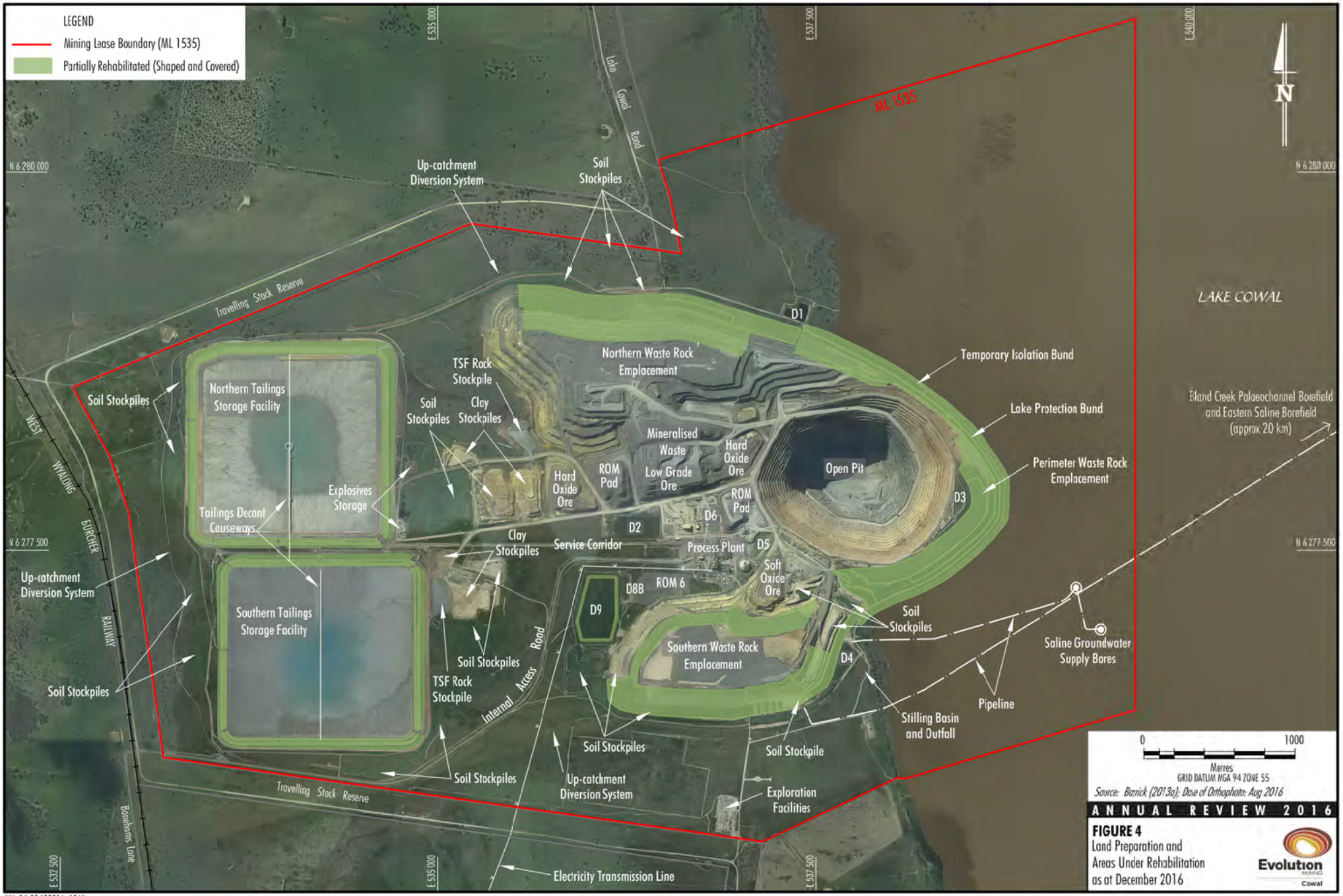
LEGEND
Mining Lease Boundary (ML 1535)
Partially Rehabilitated (Shaped and Covered)
E 535 000
E 537 500
E 540 000
N
N 6 280 000
N 6 277 500
E 532 500
Lake Cowal Road
ML 1535
LAKE COWAL
Up-catchment Diversion System
Soil Stockpiles
Travelling Stock Reserve
D1
Northern Waste Rock Emplacement
Temporary Isolation Bund
Lake Protection Bund
Perimeter Waste Rock Emplacement
Eland Creek Palaeochannel Borefield and Eastern Saline Borefield (approx 20 km)
Northern Tailings Storage Facility
TSF Rock Stockpile
Soil Stockpiles
Clay Stockpiles
Mineralised Waste
Low Grade Ore
Hard Oxide Ore
ROM Pad
Open Pit
D3
D6
D2
D5
Process Plant
Soft Oxide Ore
Explosives Storage
Tailings Decant Causeways
Clay Stockpiles
Service Corridor
ROM 6
D8B
D9
Southern Tailings Storage Facility
Southern Waste Rock Emplacement
D4
Saline Groundwater Supply Bores
Pipeline
Stilling Basin and Outfall
Soil Stockpile
Internal Access Road
WEST WYALONG BURCHER RAILWAY
Bonehams Lane
Exploration Facilities
Electricity Transmission Line
0
1000
Metres
GRID DATUM MGA 94 ZONE 55
Source: Barrick (2013a); Dow of Orthophoto: Aug 2016
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FIGURE 4
Land Preparation and Areas Under Rehabilitation as at December 2016
Evolution MINING Cowal
HAL-04-22 AR2016_106A

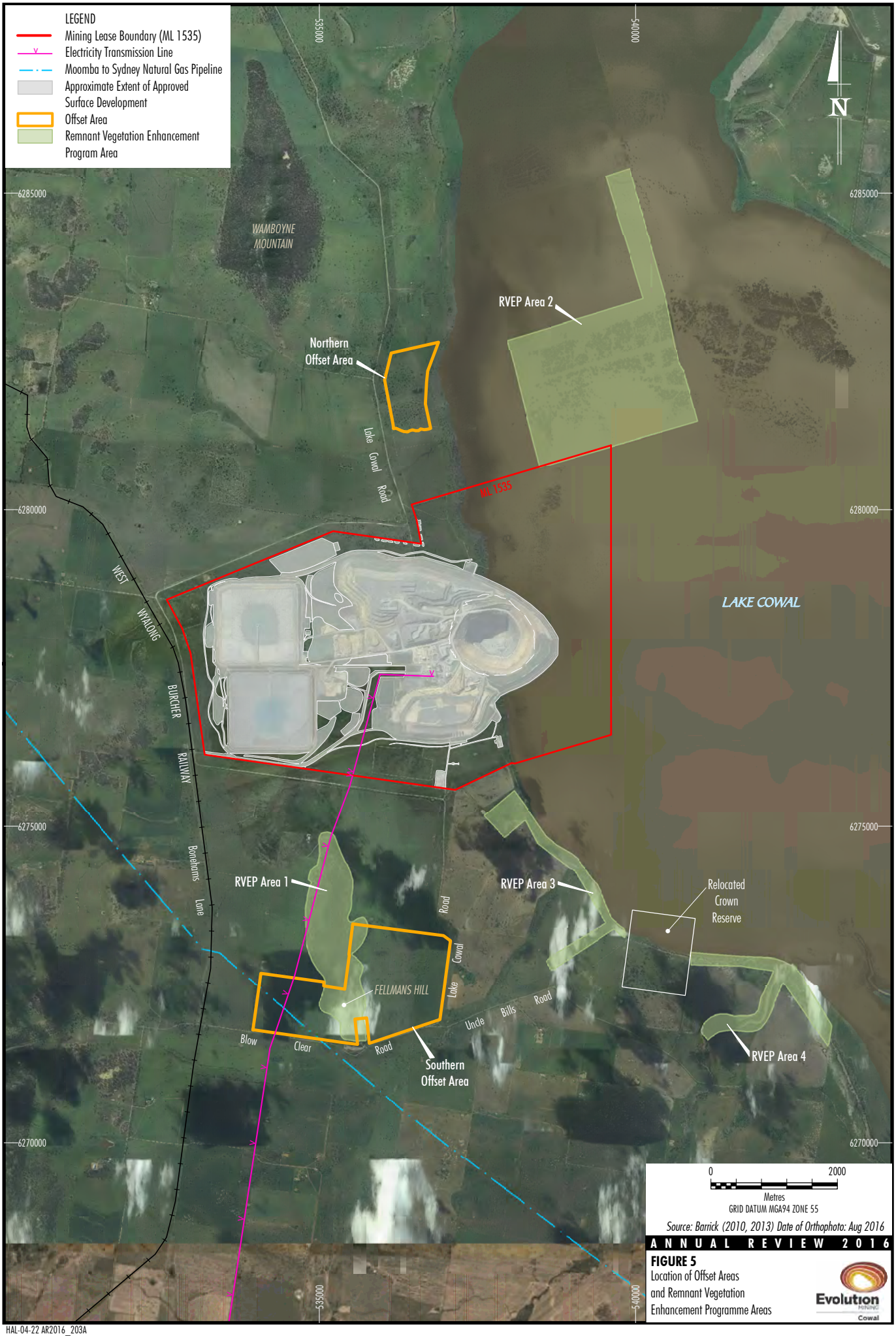

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FIGURE 5
Location of Offset Areas and Remnant Vegetation Enhancement Programme Areas

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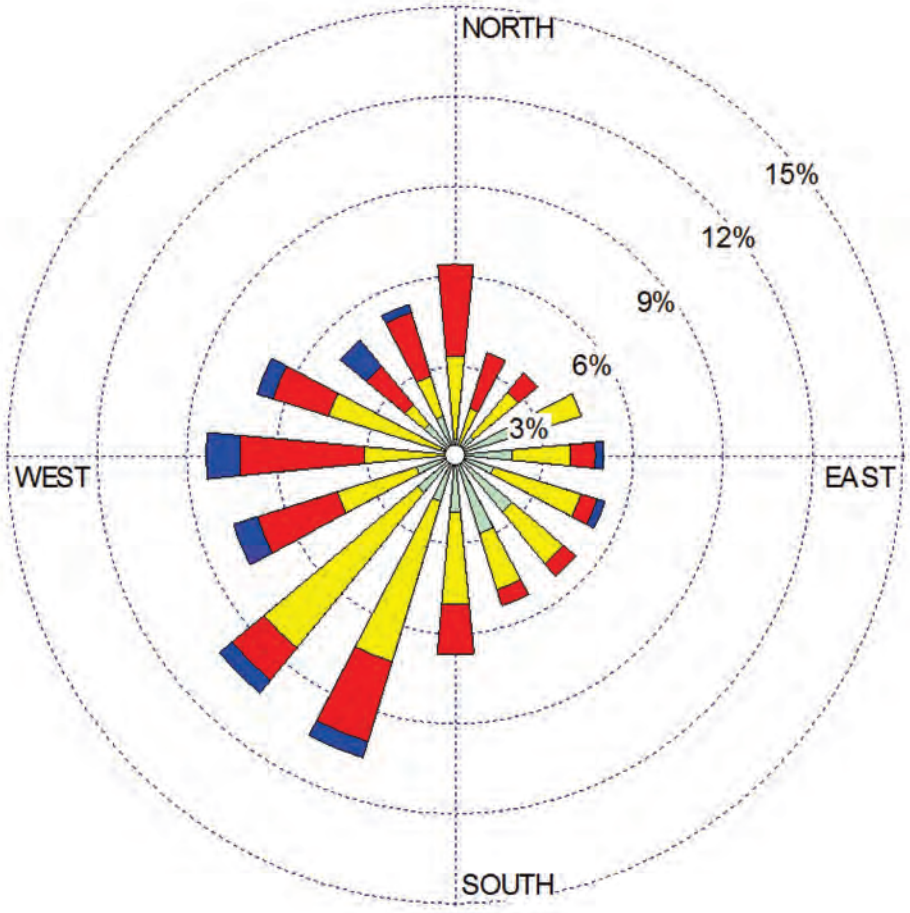
HAL-04-22 AR2016_203A



Wind speed (km/hr)

2–8	21–32
8–13	32–40
13–21	>40

Source: University of Sydney (2017)

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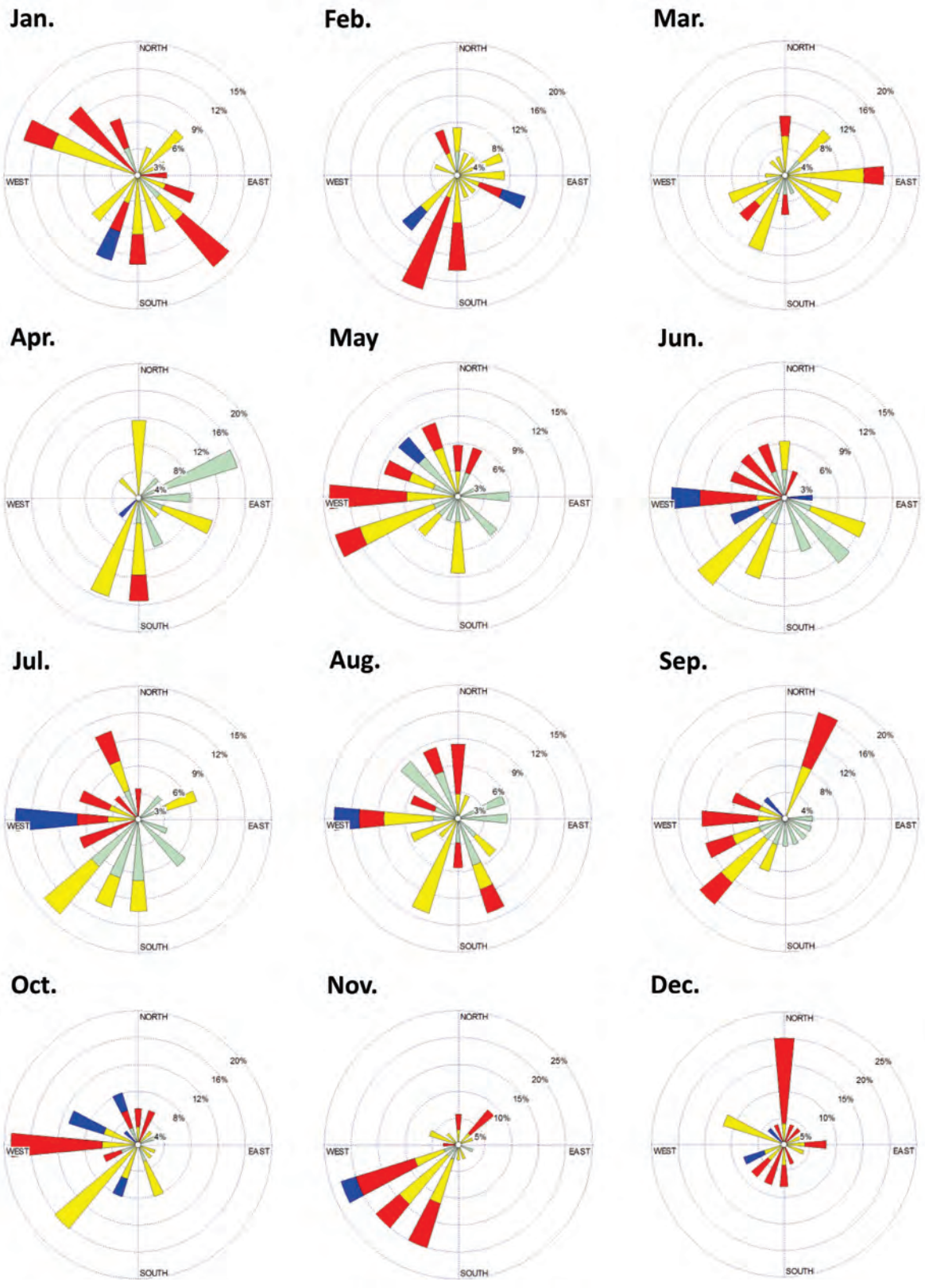
FIGURE 6a

Annual Wind Rose for 2016

Evolution Mining Cowal



Source: University of Sydney (2017)

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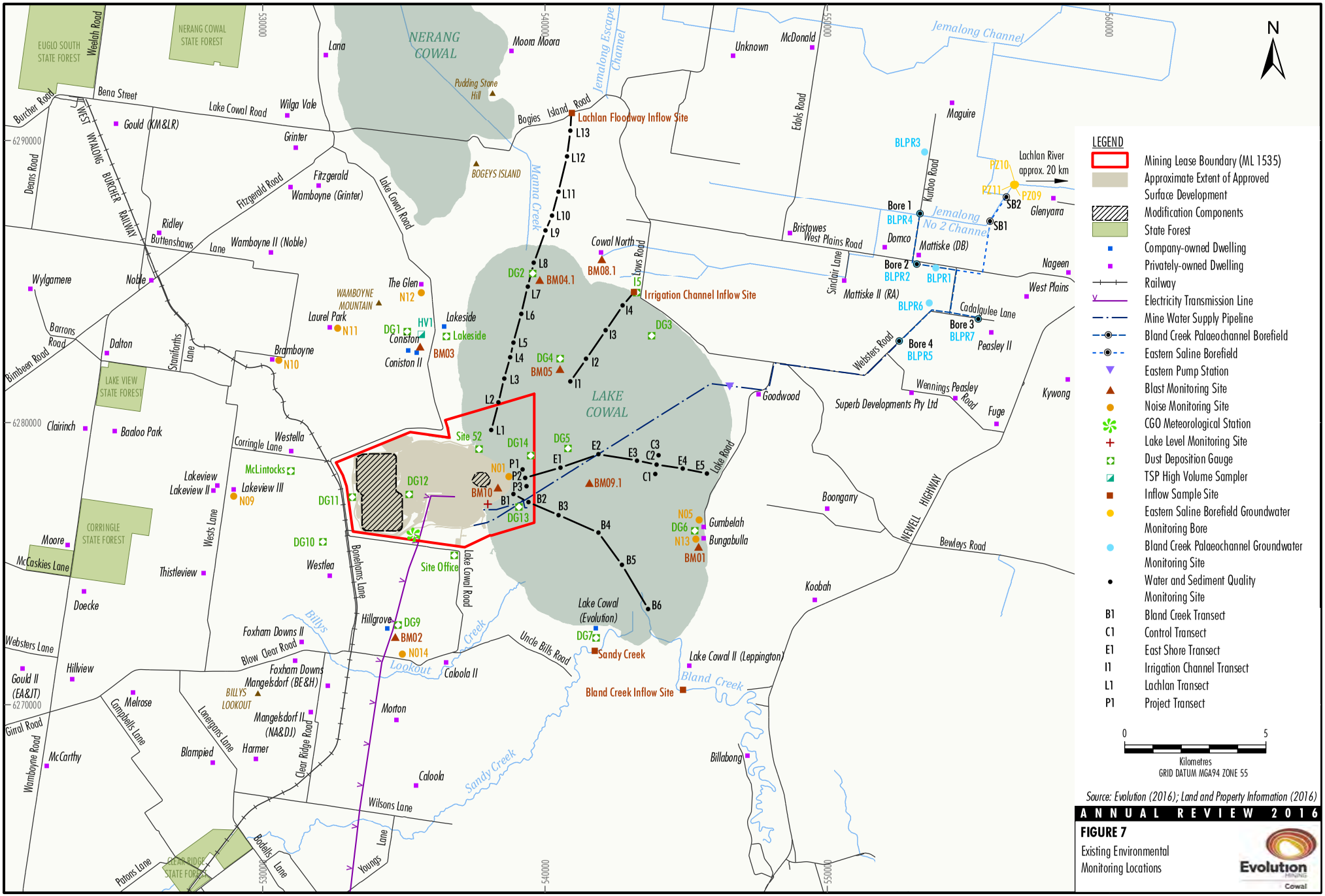
FIGURE 6b

Monthly Wind Roses for
January - December 2016

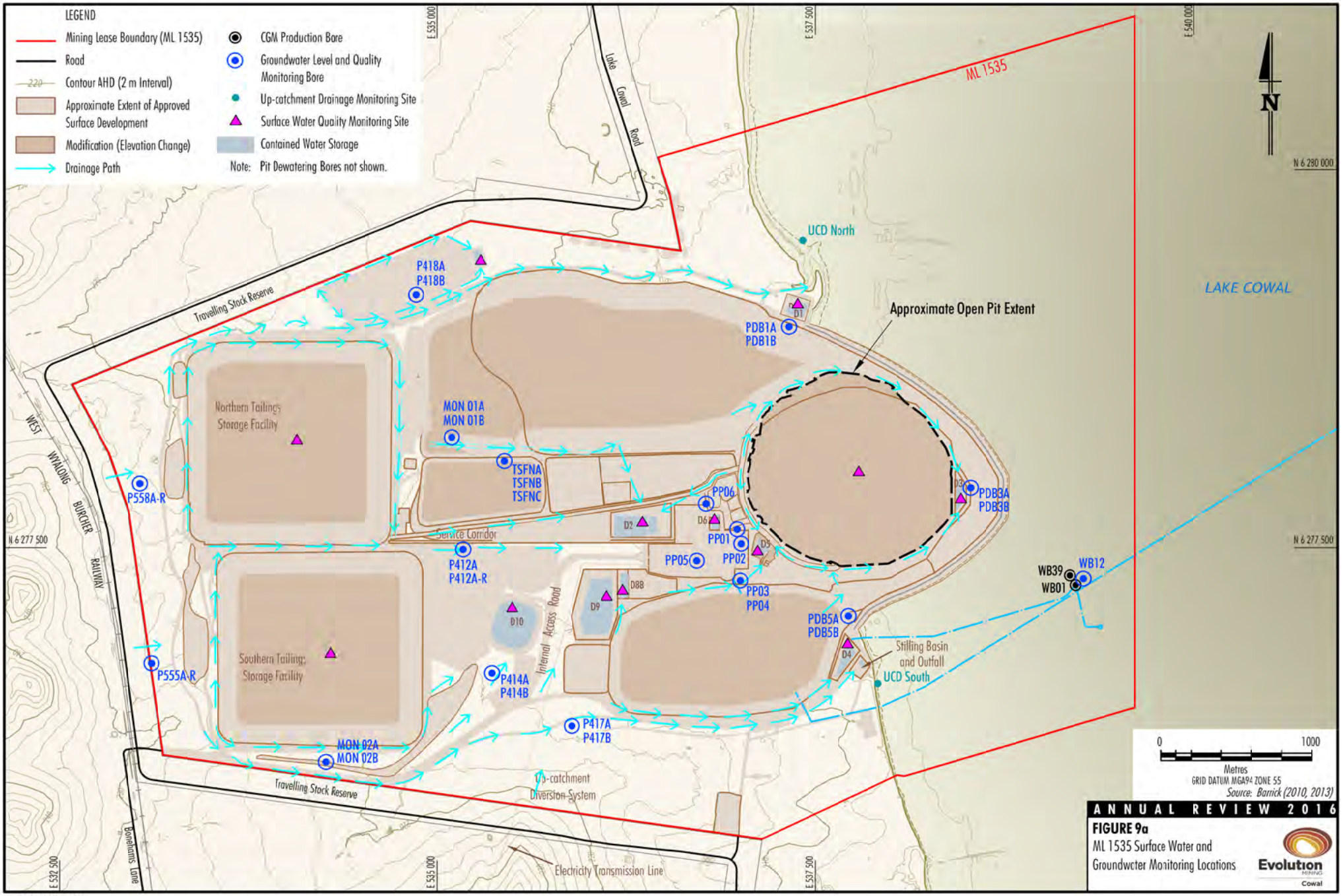
Evolution Mining Cowal

HAL-04-22_AR2016_004A



HAL-04-22 AR2016_206B

HAL-04-22 AR2016_105A



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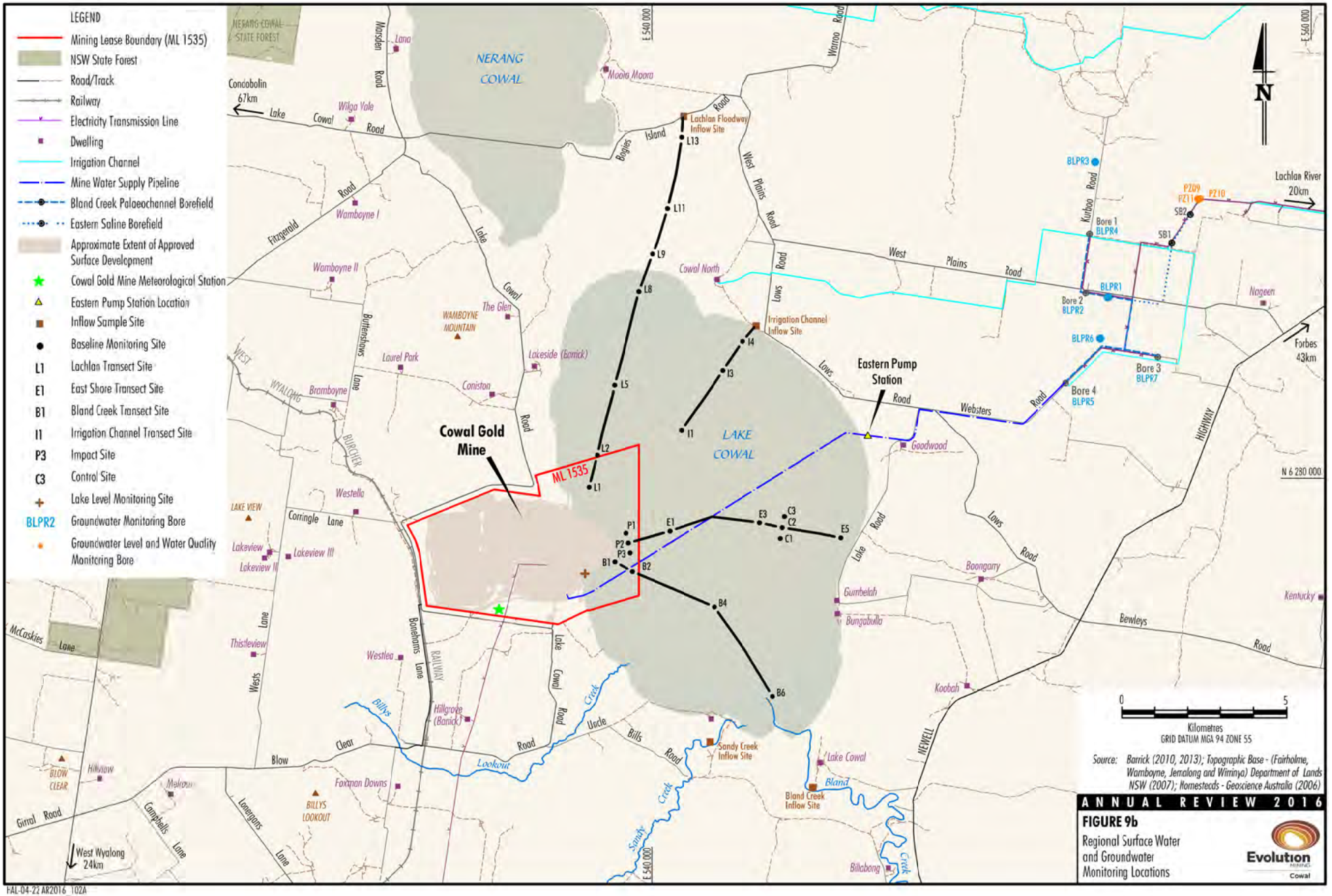

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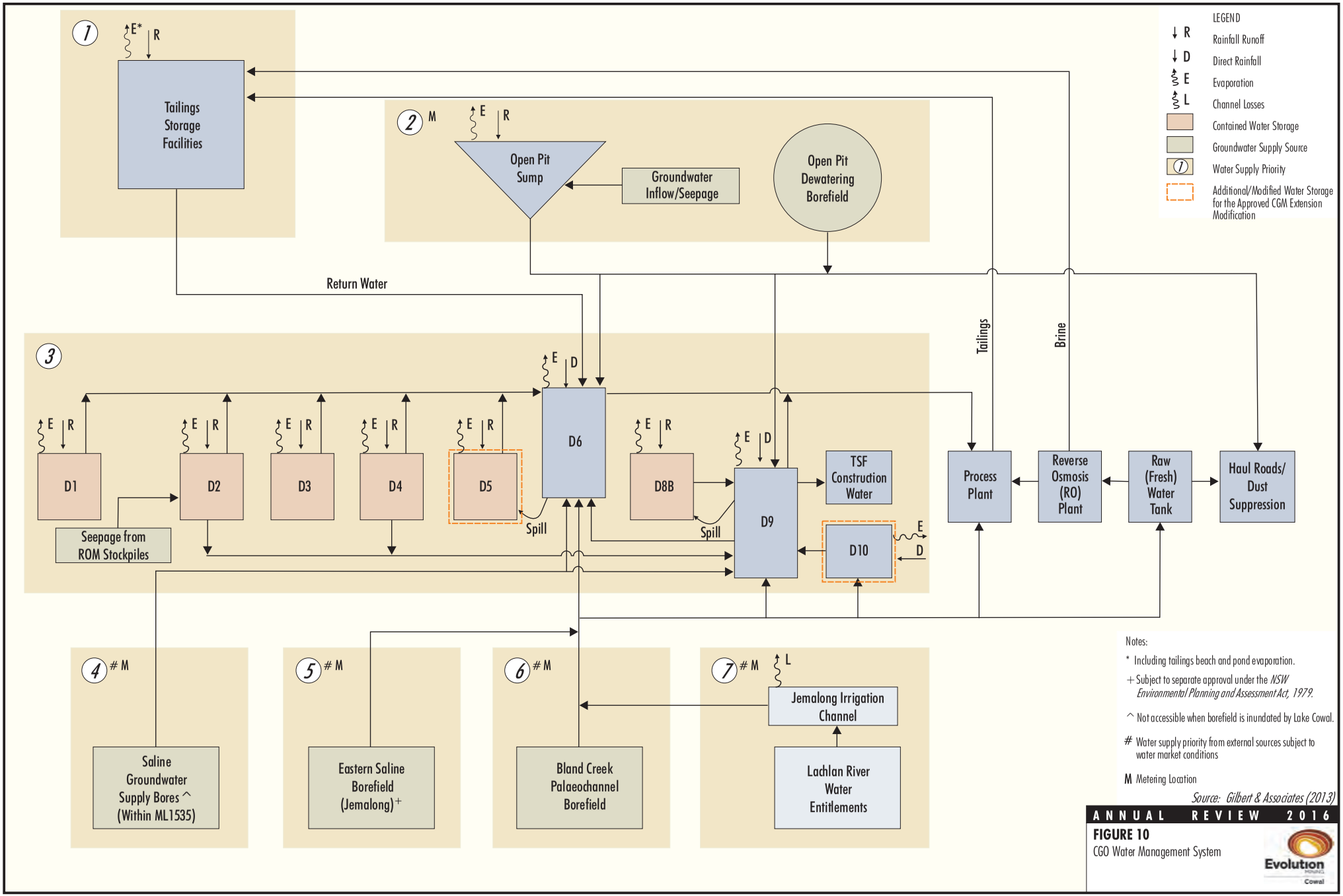

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FIGURE 10
CGO Water Management System

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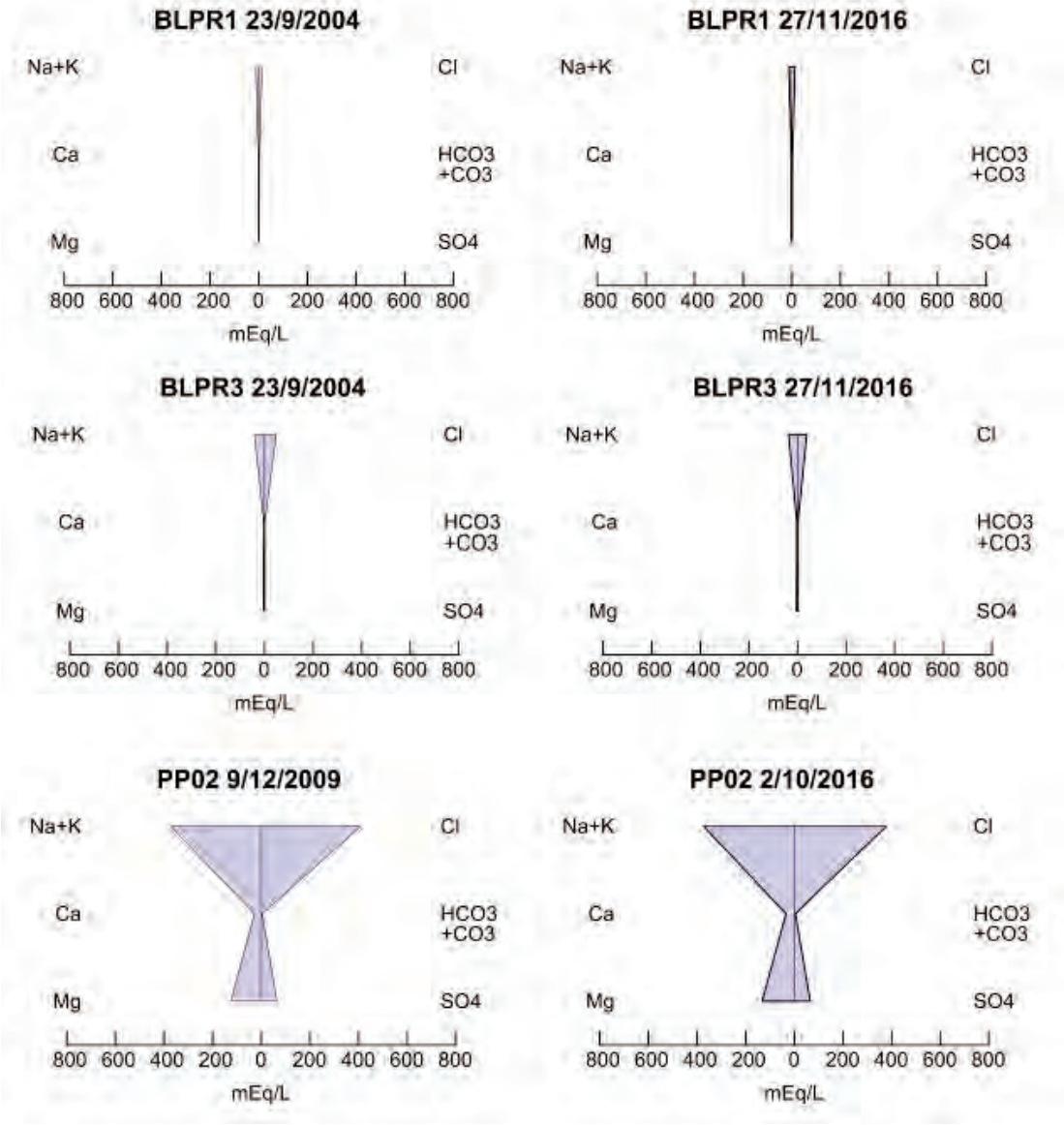

Source: Coffey Geotechnics Pty Ltd (2017)

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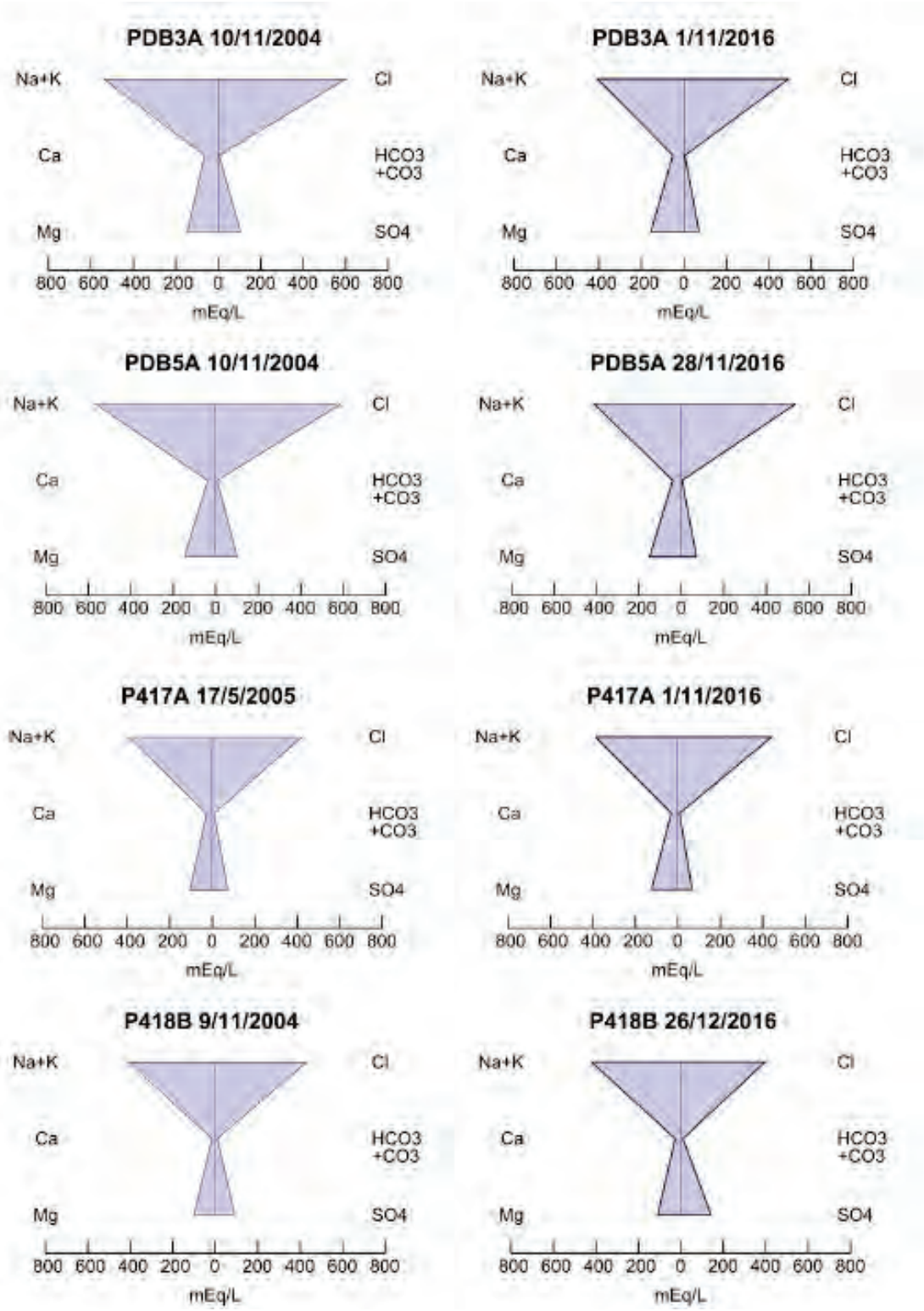
FIGURE 11a

Stiff Plots of Groundwater Chemistry (Bland Creek Palaeochannel Borefield and Processing Plant Area)



Source: Coffey Geotechnics Pty Ltd (2017)

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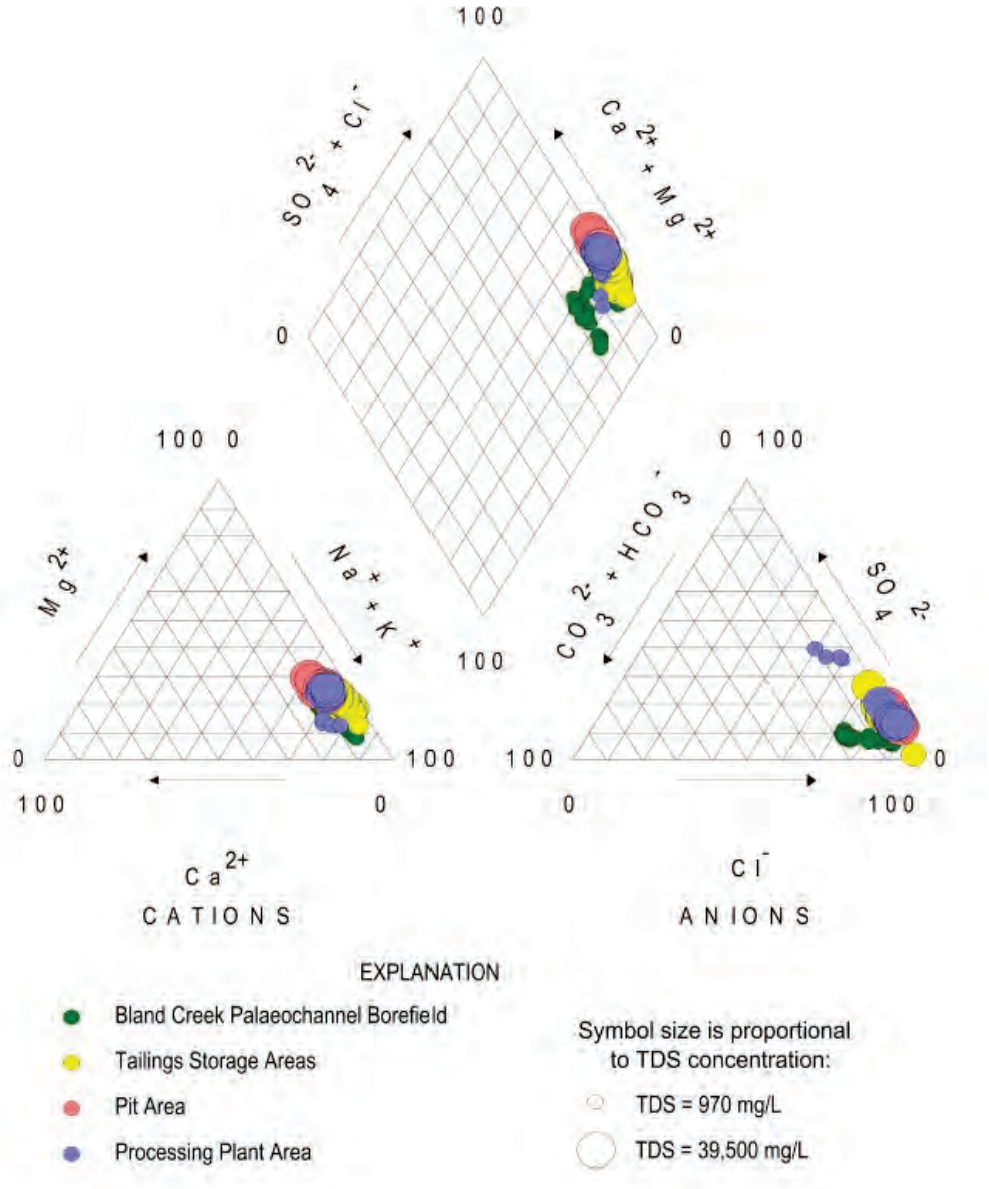
FIGURE 11b

Stiff Plots of Groundwater Chemistry
(Pit Area and Tailings Storage Facility)

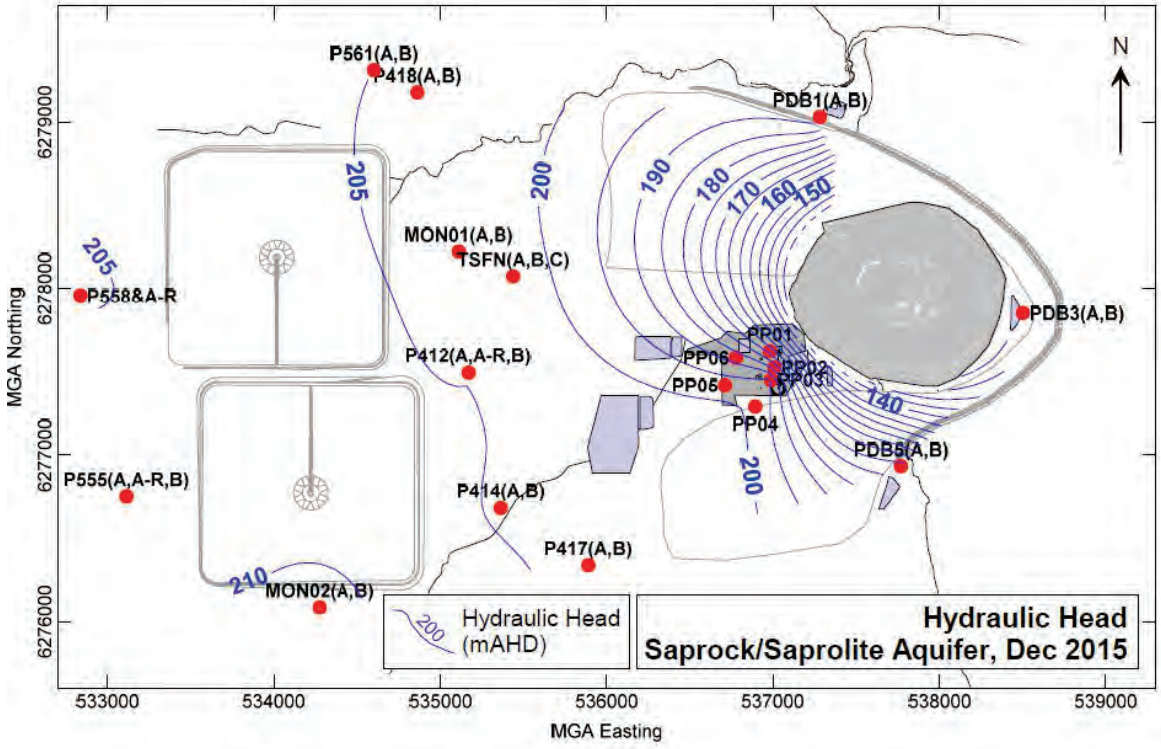
Evolution Mining Cowal

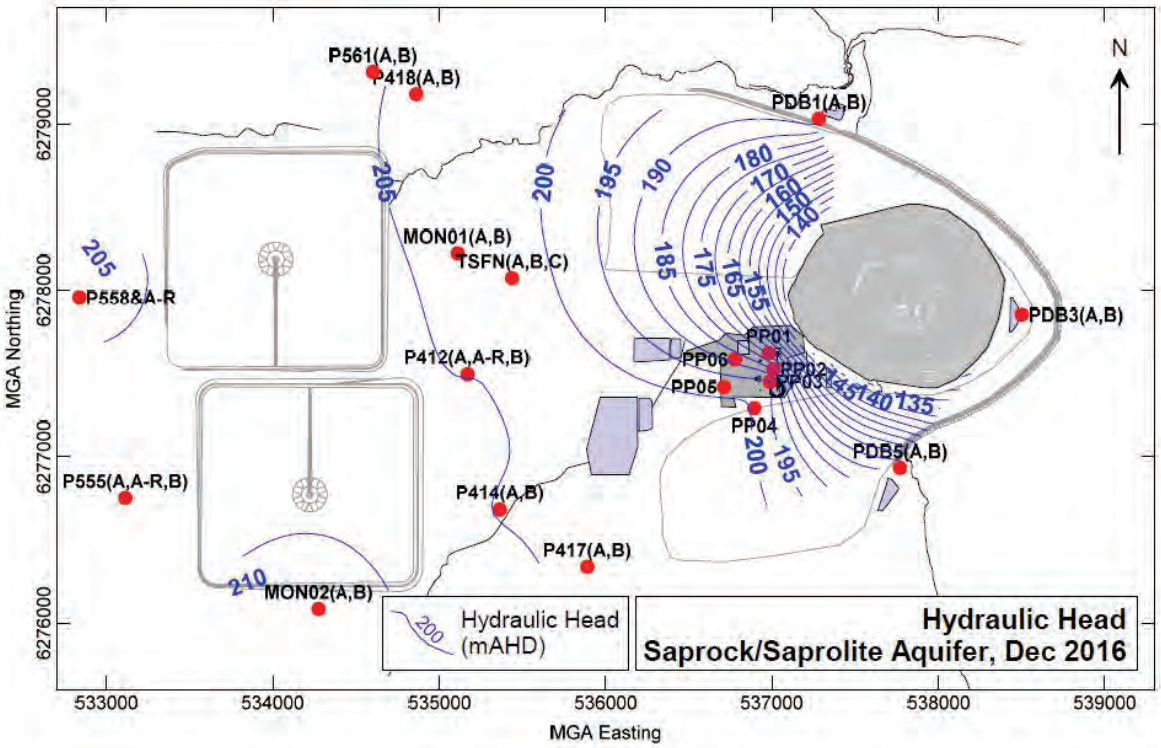


Source: Coffey Geotechnics Pty Ltd (2017)

FIGURE 12

Piper Plot of Ground Chemistry





Source: Coffey Geotechnics Pty Ltd (2017)

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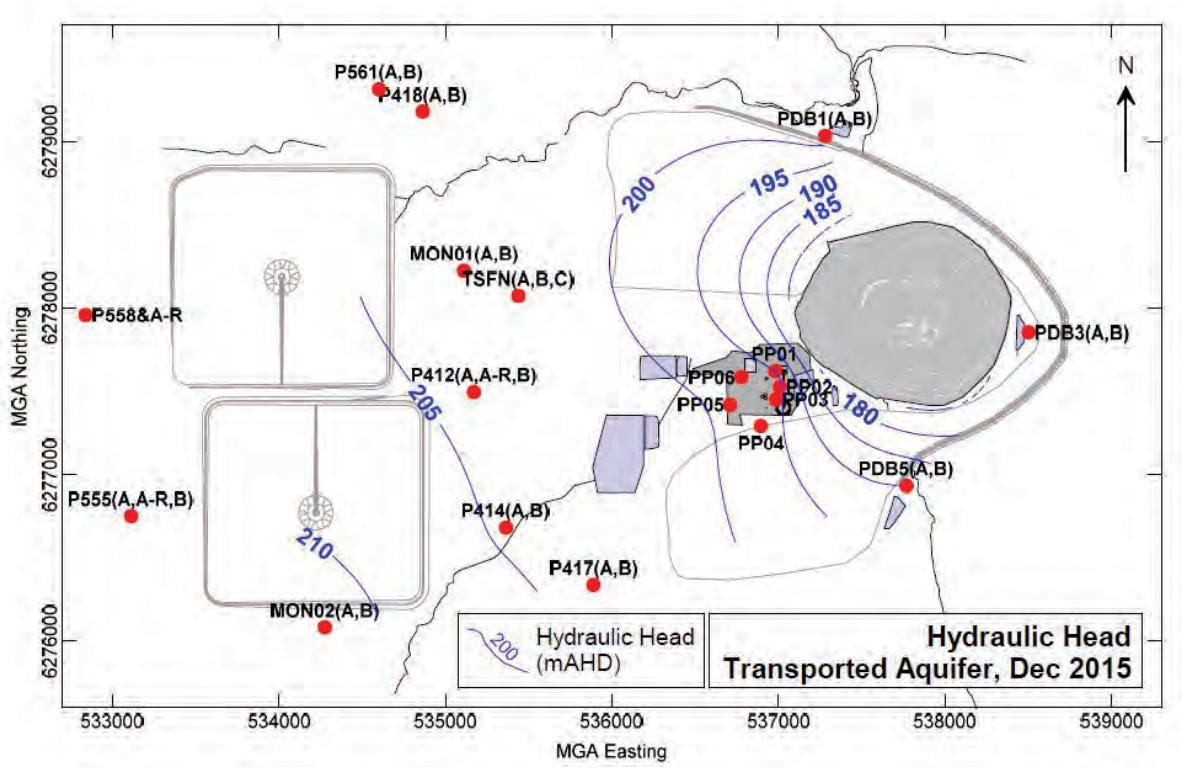
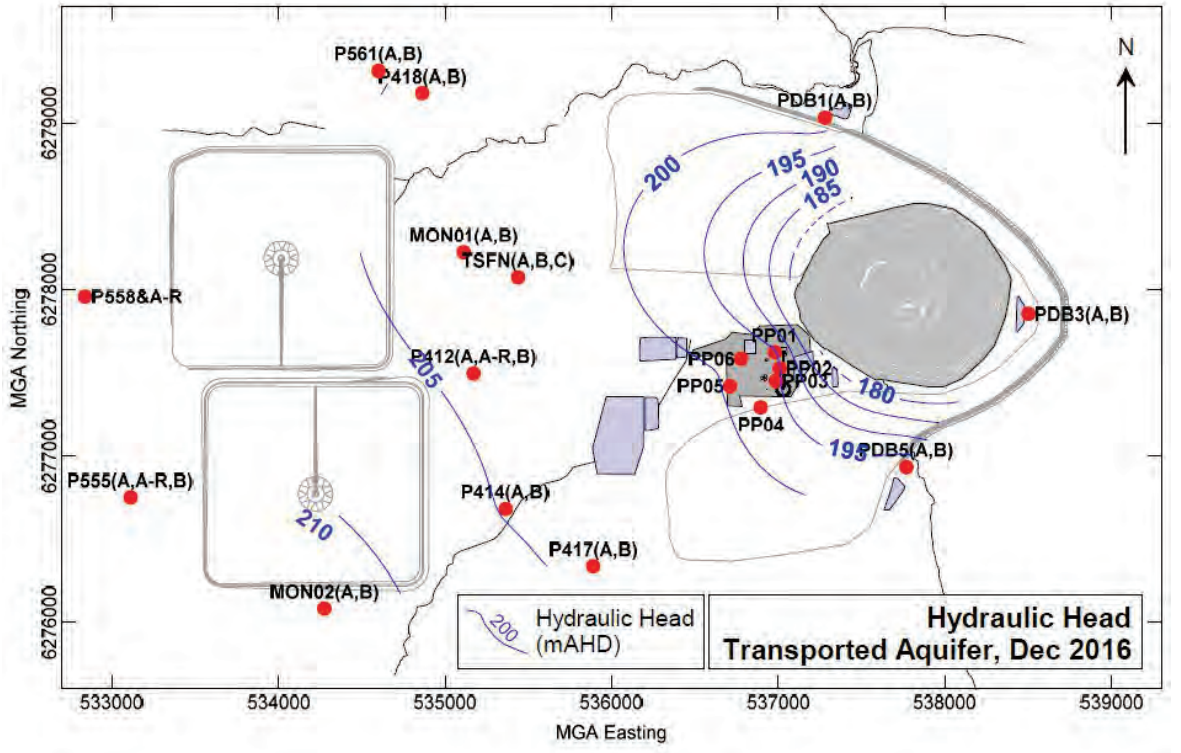
FIGURE 13a

Deep Groundwater Contours

Evolution Mining Cowal





Source: Coffey Geotechnics Pty Ltd (2017)

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FIGURE 13b

Shallow Groundwater Contours

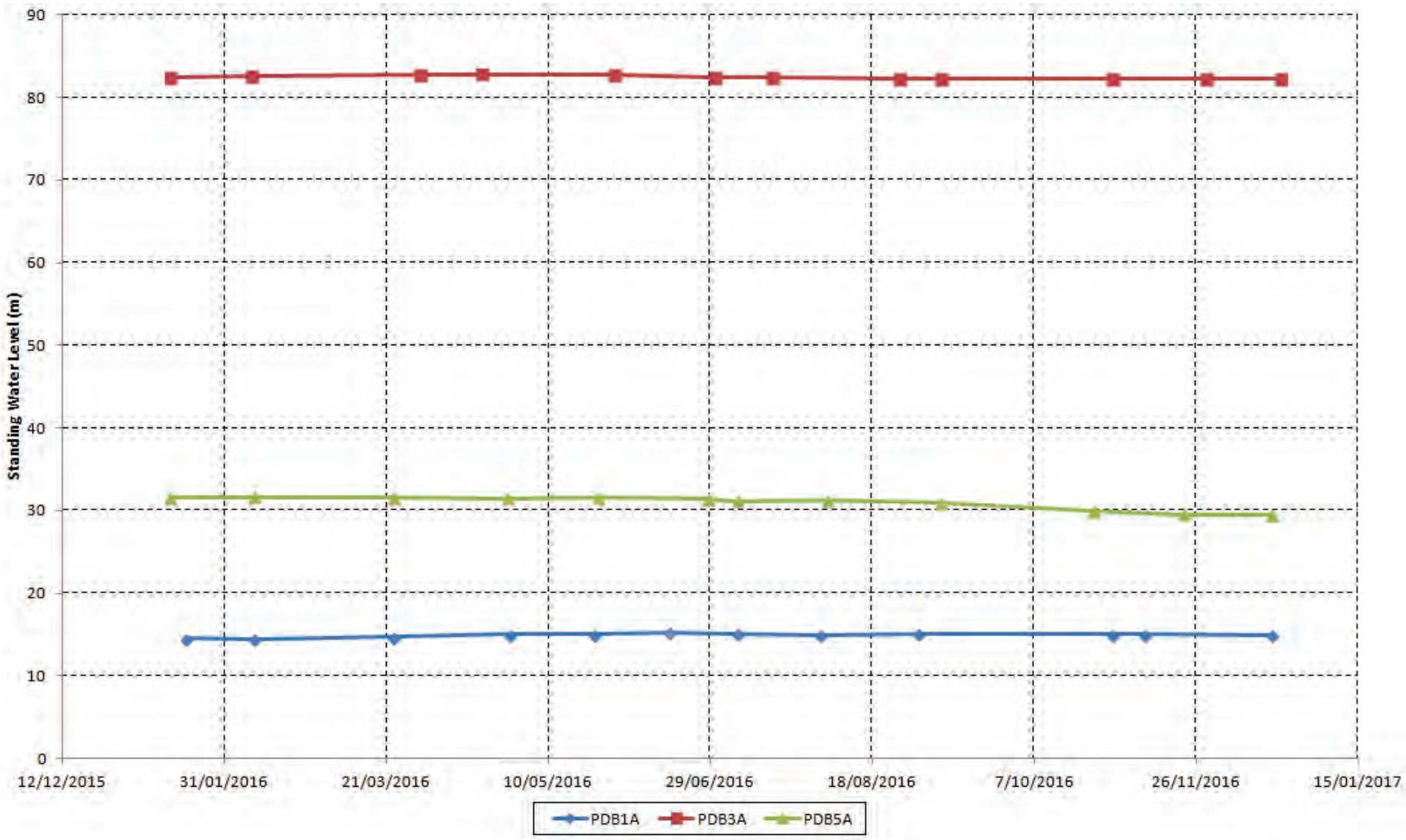

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FIGURE 14
Bores PDB 1A, 3A and 5A Standing Water Levels Measured During the Reporting Period

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FIGURE 15

Indicative Location of Soil Stockpiles - December 2016

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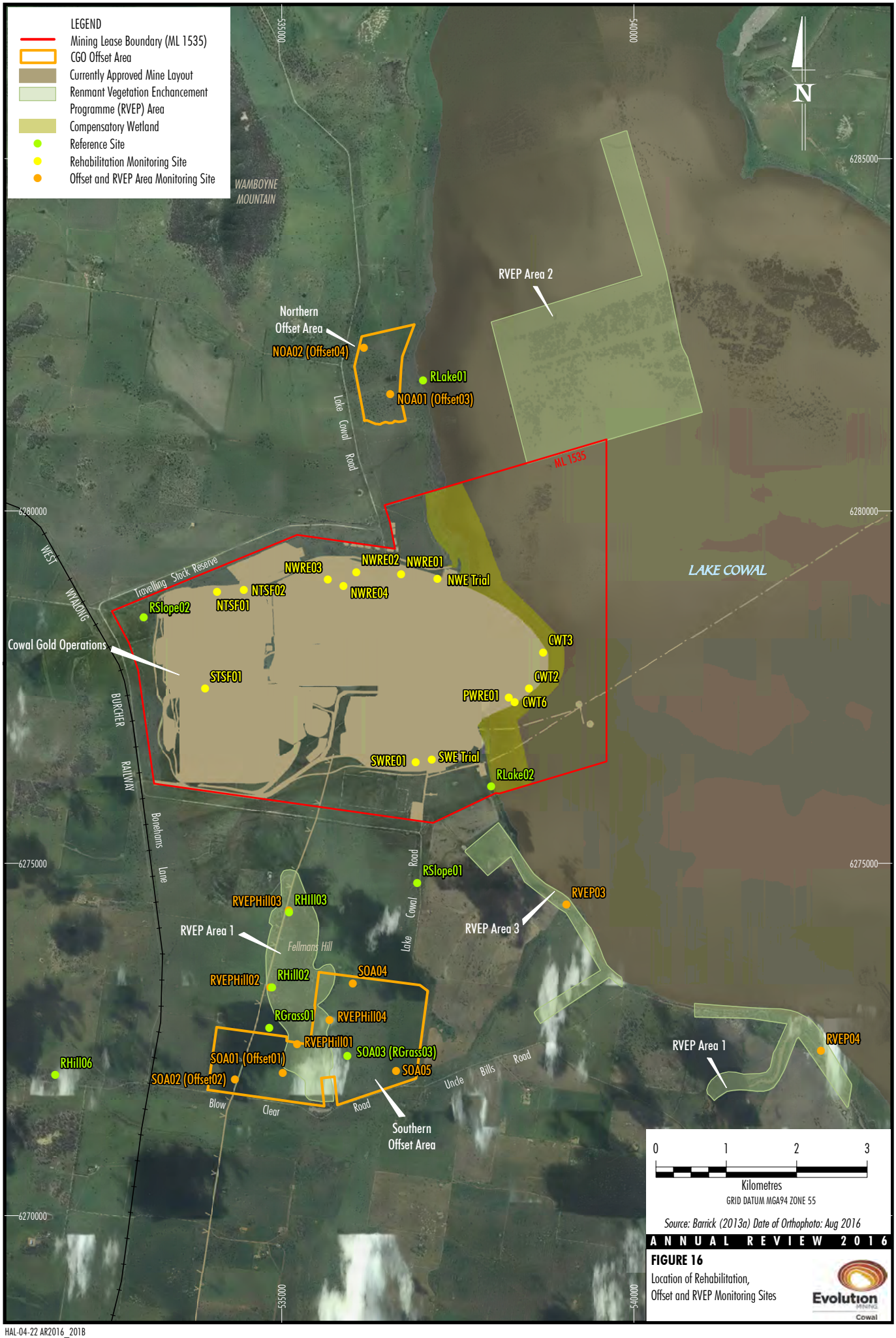

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FIGURE 16

Location of Rehabilitation, Offset and RVEP Monitoring Sites

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FIGURE 17

Conceptual Final Landform and Proposed Final Land Use Areas

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HAL-04-22 AR2016_202A