COWAL GOLD OPERATIONS

2017 ANNUAL REVIEW

COWAL GOLD OPERATIONS
2017 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 Licences	*Evolution Mining (Cowal) Pty Limited*
MOP Start Date	*1 September 2016*
MOP End Date	*31 August 2018*
Annual Review Start Date	*1 January 2017*
Annual Review End Date	*31 December 2017*

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 2017 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	*General Manager*
Signature of Authorised Reporting Officer	
Date	*30 July 2018*

Prepared by	
Name	**Danielle Wallace**
Title	**Superintendent - Environment & Social Responsibility**
Date	**30 July 2018**
Signature	
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Title	**General Manager**
Date	**30 July 2018**
Signature	

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Date	**30 July 2018**

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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 2017) 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 2017 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 October 2017 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 at the CGO are provided below:

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The street and postal addresses for the CGO are provided below:

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LAKE COWAL NSW 2671

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PO Box 210
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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	7/02/2017	Modification 13 (mine life extension from 2024 to 2032) was approved on 7 February 2017.
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	23/05/2017	Evolution submitted a licence variation to update the EPL as a result of the approval of the Modification 13. The EPL variation was approved on 23 May 2017, and was subsequently varied again and re-approved on 19 April 2018.
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	DI-Lands & Water	14/09/2012	13/9/2025	2015	Nil
Eastern Saline Borefield WAL 36569 Water supply work approval 70WA614933	DI-Lands & 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	DI-Lands & Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering WAL 36615 Water supply works approval 70WA614090	DI-Lands & Water	21/03/2014	13/09/2025	13/09/2015	Nil
Pit dewatering WAL 36617 Water supply works approval 70WA614090	DI-Lands & Water	21/03/2014	13/09/2025	13/9/2015	Nil
Monitoring and test bore licences	DI-Lands & Water	Various	Various	2015	Nil
High Security Title WAL13749	DI-Lands & Water	21/12/2006	Life of ML	21/12/2006	Nil
High Security Title WAL14981 (80 Units)	DI-Lands & Water	15/09/2011	Life of ML	15/092011	Nil
General Security WAL13748	DI-Lands & Water	21/12/2006	Life of ML	21/12/2006	Nil
Lake Cowal pipeline and Temporary Isolation Bund and Lake Protection Bund structures Water Supply Works Approval 614805	DI-Lands & 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.

DI-Lands & Water: Department of Industry – Lands & Water.

DRG: Division of Resources and Geoscience – within the Department of Planning and Environment (previously the Division of Resources and Energy).

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 submitted to the DP&E during the reporting period:

- Transport of Hazardous Materials Study addendum (ammonium nitrate and ammonium nitrate emulsion) (submitted March 2017);
- Cyanide Management Plan (submitted April 2017);
- Noise Management Plan (submitted July 2017);
- Erosion and Sediment Control Management Plan (submitted July 2017);
- Environmental Management Strategy (submitted July 2017);
- Surface Water, Groundwater, Meteorological, Biological Monitoring Programme (submitted August 2017);
- Lake Protection Bund, Water Storage and Tailings Structures and Pit Void Walls Monitoring Program (submitted August 2017);
- Water Management Plan (submitted August 2017);

- Hazardous Waste and Chemical Management Plan (submitted August 2017); and
- Emergency Response Plan (submitted October 2017).

In addition, the Rehabilitation Management Plan (RMP) was submitted to the DRG in September 2017 (as part of an amendment to the Mining Operations Plan [MOP]), and was subsequently approved in October 2017.

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	2016 AR	2017 AR	2018 AR (Forecast)
Ore (t)	N/A	9,213,744	9,236,053	7,206,891
Mineralised Waste (t)	N/A	853,425	1,186,787	598,915
Waste Rock (t)	N/A	2,211,263	5,074,806	24,204,894
Northern Waste Rock Emplacement (NWRE) (m AHD)	308[1]	268	268[3]	268[3]
Southern Waste Rock Emplacement (SWRE) (m AHD)	283[1]	254	278	273
Perimeter Waste Rock Emplacement (PWRE) (m AHD)	233[1]	225	209	209
Tailings Storage Facilities (TSFs)				
Northern TSF (NTSF) (m AHD)	264[1]	236	236	240.5
Southern TSF (STSF) (m AHD)	272[1]	239	244	243.7
Mill Throughput (Mtpa)	7.5[2]	7.2	7.4	7.5
Saleable Product (oz)	N/A	273,055	259,480	244,641

[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 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 2017.

Run-of-mine (ROM) 8 and ROM 9 stockpiles were constructed on top of the NWRE at 1,268 m RL in February and August 2017 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 2017 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 2017.

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 has commenced for the next reporting period.

Tailings were deposited into the Stage 5 lift (4th augmentation) of the STSF from the 1st January to 23rd January 2017 until switching to the Stage 5 lift (4th augmentation) of the NTSF on the 24th January 2017 and continuing for the remainder of the reporting period. Construction works started on the Stage 6 lift (5th augmentation) of the STSF 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).

4.2 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 39,530 m of drilling was completed within ML 1535 during the reporting period including:

- A total of 1,587 holes for 35,050m in-pit RC drilling.
- A total of six holes for 4,475m 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. 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 2018, and is outlined in the currently approved MOP. Geotechnical drilling is also proposed to be undertaken during 2018 including drilling around the NTSF and STSF.

4.3 HAZARD AUDIT

The next Hazard Audit is scheduled for 2019.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

The *2016 Annual Review* meeting was held on 12 October 2017 at the CGO. There were no actions arising from this meeting. No additional directions were given during site visits within the reporting period.

The Independent Monitoring Panel for the Cowal Gold Project completed a review in November 2017 and provided several recommendations in their Thirteenth Annual Report. These recommendations are summarised below with the CGO responses, with further details on the Evolution Mining CGO website: https://evolutionmining.com.au/wp-content/uploads/2018/06/Response-Letter-to-Thirteenth-Annual-Report.pdf

Summary of Recommendations and CGO Responses:

1. *Direct seeding trial ongoing monitoring and review*: reviews are underway and will continue annually. The review in December 2017 by DnA Environment indicated that the application of seed directly onto freshly prepared rehabilitation areas that have a rocky soil surface resulted in higher establishment. Should a review indicate that future treatments are necessary, CGO will take appropriate action to ensure implementation of required additional actions.

2. *Substrate Profile Trial implementation at the SWRE*: this trial is to be undertaken when the SWRE has reached its final height.

3. *Reporting of metal concentrations in dust samples in the 2017 Annual Review*: there is no requirement for monitoring of metals in dust in either EPL 11912 or the currently approved CGO Air Quality Management Plan (2015). As a result, Evolution will no longer report metal concentrations in dust samples.

4. *Implement 'Effective Rehabilitation' as a KPI for a senior mining department decision maker*: Targeted rehabilitation areas are included in the mining operations weekly plan which ensures project completion, timelines and accountability for all personnel involved.

5. *Ensure SOPS for revegetation are followed and procedures in place to cover gaps in staff capability to deliver rehabilitation activities*: Additional Environmental team resources have been incorporated at CGO and Evolution will continue to consult with DRG in the coming months regarding rehabilitation commitments in future Mining Operations Plans.

6. *Application for removal of the requirement to conduct an annual Austral Piwort survey*: Monitoring results since 2012 have not detected the presence of Austral Piwort and Evolution proposes to seek the removal of this requirement.

7. *CGM to explore a coordinated approach to Lippia control around Lake Cowal with Council and the Lake Cowal Foundation*: Evolution will seek to consult with the Bland Shire Council and Lake Cowal Foundation to assist in further controlling Lippia on Evolution-owned land with frontage to Lake Cowal.

8. *CGM to record the IMP's recommendations in the 2017 Annual Review*: completed.

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 2017 Independent Environmental Audit (IEA) was conducted between 15 and 19 May 2017 by Trevor Brown of Trevor Brown & Associates 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 2017 IEA is provided on Evolution's website - http://evolutionmining.com.au/cowal/.

Evolution has fully complied with the commitments of the DRG (formerly DRE) approved MOP during the reporting period, and any subsequent updates approved by the DRG.

The EPL 11912 Annual Return for the 23 December 2016 to 22 December 2017 reporting period was submitted to the EPA on 17 February 2017. In the 2017 Annual Return, Evolution identified non-compliances related to monitoring not being undertaken at some surface water, dust and blast monitoring points. The reasons for the non-compliances included no water present at sample locations, broken sample jars during transit, equipment faults etc. 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 Air Quality Management Plan (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 unsealed ML 1535 roads around the general administration and processing 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 399.4 millimetres (mm). 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 static dust deposition gauges was used throughout 2017 to collect monthly dust samples. At the commencement of 2017, 18 dust gauges were in use, but due to a variation of the EPL 11912 four of these gauges were de-commissioned at the end of February 2017 and a further two were de-commissioned at the end of June 2017. The dust gauges are located at varying distances from the CGO open pit, and in a range of directions from the pit. A number of the gauges are situated near homesteads of properties that adjoin the mine site, and a number are near areas of ecological importance.

The high volume air sampler (HVAS) was used throughout 2017 to obtain measurements of suspended solids, every six days until February 26th, 2017, and then every 7 days thereafter, to reflect changes in the EPL 11912. The HVAS collects suspended particles with diameters less than approximately 50 µm. This enables determination of dust concentrations in units of mass per cubic metre (µg/m^3).

Table 5: Monthly Rainfall Measured at CGO AWS 2010 – 2017

Month	2010 (mm)	2011 (mm)	2012 (mm)	2013 (mm)	2014 (mm)	2015 (mm)	2016 (mm)	2017 (mm)
January	2.8	24.4	26.6	5.20	32.0	75.8	67.0	24.8
February	95.6	138.6	129.2	26.0	23.2	11.0	1.4	8.6
March	44.6	146.2	78.0	45.4	71.0	0.4	16.8	45.4
April	50.6	20.2	15.6	3.4	20.2	56.8	11.4	18.6
May	40.0	22.0	32.6	30.4	21.2	12.8	61.8	31.0
June	22.8	29.4	29.6	87.8	59.4	27.2	122.6	7.6
July	62.2	11.8	49.8	33.4	9.0	77.2	72.6	27.8
August	34.0	41.8	19.0	18.8	10.8	49.0	31.2	22.4
September	64.2	13.8	25.0	60.4	16.8	8.6	136.8	0.8
October	94.0	31.0	16.0	7.2	15.2	52.6	28.8	38.0
November	60.2	130.4	36.4	9.0	1.6	24.6	28.0	50.6
December	111.7	135.0	27.0	14.6	48.4	19.2	24.8	123.8
TOTAL	**682.7**	**744.6**	**484.8**	**341.6**	**328.8**	**415.2**	**603.2**	**399.4**

Table 6: Monthly Average Meteorological Data (2017)

Aspect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Mean Humidity (%)	38.2	36.5	54.0	57.0	69.7	72.9	67.7	64.6	45.6	50.1	44.4	46.9
Mean Pressure (mbar)	984.4	986.8	987.9	996.0	995.9	1002.5	995.4	994.8	991.4	990.2	990.0	984.4
Mean Wind Direction (º)	160	170	109	128	166	177	215	217	205	150	89	172
Mean Wind Velocity (m/s) 15min	3.7	3.7	3.6	3.0	2.2	2.1	2.4	3.1	3.5	3.3	3.6	3.4
2m Temp Min (ºC)	18.6	16.9	16.2	9.1	5.9	1.0	1.1	1.9	4.6	10.1	13.9	16.7
2m Temp Max (ºC)	38.9	37.3	32.7	25.3	21.0	17.3	17.6	17.7	23.6	28.7	31.4	34.4

% - percentage; mbar – millibar; m/s – metres per second; º – degrees; ºC – degrees Celsius.

The HVAS monitor is located at a company owned residence near the CGO. The TSP criteria adopted by the EPA were recommended by the National Health and Medical Research Council of Australia as the maximum permissible level of TSP in the air to protect public health in residential environments.

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. After an EPL 11912 variation in February 2017, the duplicate gauges were reduced to DG01 and DG13. 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/m³]). Compared to previous years, the TSP level in 2017 (27 µg/m³) is lower than 2016 (33 µg/m³), 2015 (36 µg/m³), 2014 (46 µg/m³), 2013 (44 µg/m³), 2012 (34 µg/m³), 2011 (28 µg/m³), 2010 (39 µg/m³), 2009 (63 µg/m³) and 2008 (43 µg/m³).

In contrast to previous years of TSP measurements at CGO, the seasonality of the 2017 TSP data was not particularly strong. Typically, TSP values are higher in summer, early autumn and late spring, and lower during winter, but in 2017 TSP values were fairly consistent from the start of January until mid-May (average of 32 µg/m³), when the HVAS suffered a major fault. After the HVAS was repaired, the TSP data showed an increase from the end of winter into the warmer months, but from mid-August until the end of December the TSP values were again fairly consistent (average of 29 µg/m³). The lack of any TSP values greater than 53 µg/m³ was a notable feature of the 2017 dataset.

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 was 27µg/m³ (University of Sydney, 2017). Accordingly, the annual average PM_{10} is calculated at 10.8µg/m³, well below the 30µg/m³ long term impact assessment criteria (Table 8).

The short-term impact assessment criterion for PM_{10} is 50 µg/m³ (Table 9). No exceedances of the short-term impact assessment criterion for PM_{10} of 50 µg/m³ occurred during the reporting period.

Deposited Dust

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 2017 Air Quality Monitoring Results Cowal Gold Operations*. A summary of the key findings is provided below (University of Sydney, 2017):

- Temporal and spatial variation in reported monthly dust deposition was moderately strong during 2017. Monthly deposition of 10 g/m^2/month was exceeded 15 times in 2017, across nine different months and across 10 different gauges (Plate 1) (Table 10).
- Changes in monthly dust deposition rates were strongly correlated with season for some gauges, and not correlated for others. For those gauges with a strong seasonal correlation, average dust deposition was generally lower in late autumn and winter, and higher in spring, summer and early autumn. Monthly dust deposition rates averaged across all gauges ranged from 1.3 to 7.0 g/m^2/month, and only in the July and December sampling periods did the majority of gauges receive relatively high rates of deposition.
- Compliance with the assessment criterion of 4 g/m^2/month average annual deposited dust was achieved at four out of the seven compliance gauges[1] during 2017. Of these four, three (DG1, DG7, DG9) of the four were located at residences and/or ecologically sensitive locations.
- Of the three remaining compliance gauges external to ML 1535 that exceeded the assessment criterion of 4 g/m^2/month, the cause of the exceedances can largely be attributed to one or two substantial deposits (>10 g/m^2/month) in different months. The DG6 gauge received 16.4 and 11.9 g/m^2/month during the October and November sampling periods, the McClintock's Shed gauge received 10.5 g/m^2/month during the May sampling period, and the Site Office gauge received 13.9 g/m^2/month during the December sampling period. In these four deposits, the combustible fraction comprised between 36% and 90% of the total deposit; if these combustible fractions were removed the average dust deposition for these three gauges would all fall to less than 4 g/m^2/month.
- Two of the five dust gauges within the ML 1535 area (DG11, DG12) recorded an annual average dust deposition above the assessment criterion. In the case of DG11, the exceedance was largely due to three dust deposits exceeding 10 g/m^2/month between June and August, while for DG12, dust deposits exceeded 4 g/m^2/month for nine of the 12 sampling periods. Levels recorded in the gauges inside the ML 1535 area are not relevant to the CGO Development Consent conditions.

Plate 1: Elevated Depositional Dust Gauge within Lake Cowal

[1] Of the 12 depositional dust gauges installed for the CGO during 2017, seven are located outside the ML 1535 boundary and, therefore, relevant to the assessment criterion for annual average deposited dust.

Table 10: Monthly and Mean Dust (Insoluble Solids) Deposition Rates (2017)

Dust Gauge Site	Monthly deposition of insoluble solids in dust (g/m2/month)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
DG1	3.0	0.8	2.2	1.3	0.8	0.6	0.4	0.3	0.8	1.1	2.0	1.6	**1.2**
DG2*	0.3	2.9	–	–	–	–	–	–	–	–	–	–	**–**
DG3*	7.5	2.5	–	–	–	–	–	–	–	–	–	–	**–**
DG4*	4.5	1.2	–	–	–	–	–	–	–	–	–	–	**–**
DG5*	13.8	3.9	–	–	–	–	–	–	–	–	–	–	**–**
DG6^	5.1	–	4.7	1.1	7.2	2.3	3.3	5.3	2.9	16.4	11.9	7.5	**6.2**
DG7	3.2	6.4	2.4	0.7	0.9	1.2	8.6	0.4	0.8	4.4	3.7	11.5	**3.7**
DG9^	3.9	2.7	2.3	0.4	0.5	0.5	0.7	0.4	0.4	–	7.1	4.5	**2.1**
DG10	0.5	0.7	0.8	0.7	1.5	0.6	–	–	–	–	–	–	**–**
DG11	2.4	0.9	8.9	0.8	4.8	14.1	11.5	11.0	3.0	2.5	1.0	1.2	**5.2**
DG12	4.3	4.6	1.8	3.1	2.8	5.8	6.5	4.3	7.2	11.9	5.1	12.1	**5.8**
DG13	10.3	7.0	0.7	0.7	0.8	0.5	19.1	0.3	0.9	1.6	1.4	3.8	**3.9**
DG14	4.1	0.4	1.3	0.7	0.6	0.3	18.6	0.4	0.7	4.5	1.8	3.6	**3.1**
McClintock's Shed#	1.3	1.1	3.7	2.8	10.5	–	5.0	2.3	2.4	4.3	6.3	5.1	**4.1**
Site Office	2.7	0.9	8.5	0.5	3.6	3.3	2.1	4.6	3.2	3.2	4.7	13.9	**4.3**
Site 52^^	2.0	0.7	1.9	1.1	1.4	1.5	–	0.4	1.5	4.4	2.9	3.0	**1.9**
I5^	5.6	6.0	3.4	3.1	0.6	0.3	0.7	4.0	1.1	–	9.0	6.3	**3.9**
Lakeside	2.1	3.1	14.7	1.8	1.8	0.7	–	–	–	–	–	–	**–**
Mean	**4.3**	**2.7**	**4.1**	**1.3**	**2.7**	**2.4**	**7.0**	**2.8**	**2.1**	**5.4**	**4.7**	**6.2**	**–**

* Dust gauges were de-commissioned after the February sampling period.

** Dust gauges were de-commissioned after the June sampling period.

^ The February sample for DG6, and the October samples for DG9 and I5 were destroyed in transit from the field to the laboratory.

The June sample for McClintock's Shed was contaminated with grass and dung, and therefore excluded.

^^ The July sample for Site 52 was contaminated during sampling and excluded.

Temporal and spatial variation in reported monthly dust deposition was moderately strong during 2017, although distinctly less than in 2016 when flood waters inundated a number of gauges. The average dust deposition rate across all gauges used throughout 2017 was 3.8 g/m^2/month, compared to 2.7 g/m^2/month in 2015 and 2.8 g/m^2/month in 2014. This comparatively larger average for 2017 can be partially explained by the de-commissioning of some of the more remote dust gauges (from the mine), which have historically received low amounts of deposited dust, thus reducing the annual average (University of Sydney, 2017).

The gauges *DG1*, *DG9*, *DG13, DG14* and *Site 52* all received less than 2.0 g dust/m^2 for at least six of the twelve monthly sampling periods, while the gauges *DG6* and *DG12*, received more than 4.0 g dust/m^2 for six or more of the twelve sampling periods. In six of the monthly sampling periods (January, March, July, October, November, December), average dust deposition across all gauges exceeded 4 g/m^2/month. Fifteen reported dust deposits were comprised of 10 g/m^2/month or more in 2017; of these, nine contained an organic component comprising more than 50% of the deposit, suggesting 'contamination' by insects, bird droppings and vegetative matter (straw). For the other six dust deposits, because not all gauges received large amounts of dust in the same sampling period, a very localised event such as contamination by birds (muddy claws), vandalism, or dust generation very close to the gauge, must have occurred (University of Sydney, 2017).

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 2017 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	2017 Monitoring Results	Predicted Result at Coniston[1]	Development Consent Air Quality Impact Assessment Criteria
Maximum 24 Hour Average PM_{10}	21.1 µg/m^3	28.8 µg/m^3	50 µg/m^3
Annual Average PM_{10}	10.8 µg/m^3	3.7 µg/m^3	30 µg/m^3
TSP	27 µg/m^3	3.9 µg/m^3	90 µg/m^3
Depositional Dust	1.2 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 key recommendation of the University of Sydney's (2017) review was that although the three-monthly duplicate samples collected in 2017 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. Evolution will continue to collect the required duplicate samples at relevant sites.

6.2 BLASTING

Development Consent Condition 6.3(a) details the blast impact assessment criteria relevant to the CGO. As required by Development Consent condition 6.3(e), the Blast Management Plan (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, the 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, five 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 (MIC) 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, and at the general monitoring site BM10. Monitoring at BM04.1, BM05 and BM09.1 were not undertaken as these locations were flooded by Lake Cowal during the reporting period.

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), 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). Monitoring was also undertaken at BM03, on Evolution-owned land.

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 monitors at sensitive locations, one non-reported monitor (BM10) was located at non-sensitive location. The three (3) lake monitoring locations (BM04.1, BM05, BM09.1) are presented for reference on Figure 7, however these monitors were non-operational during 2017 after being destroyed by rising water in 2016.

Ground vibration and air overpressure monitoring was conducted with the use of Instantel Series III blast monitors. Five units were used 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 several incidences where units were offline for more than 24 hours. These incidences include the following:

- The monitoring unit at BM03 (Coniston residence) was offline from 14th to 17th January 2017 due to network communications fault.
- The monitoring unit at BM10 (Near Field reference) was offline from the 8th to 15th May 2017 due to network communications fault.
- The monitoring unit at BM08.1 (Cowal North) was offline from 17th to 18th May 2017 due to network communications fault.
- The monitoring unit at BM03 (Coniston residence) was offline for routine maintenance on the 24th October 2017.
- The monitoring unit at BM01 (Gumbelah residence) was offline from the 11th November 2017 to 15th November 2017 due to network communications fault.

6.2.2.2 Performance Outcomes

Ground Vibration

A total of 194 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 relevant ground vibration limits. The maximum blast induced vibration level at the nearest residence was 0.27 mm/s recorded at BM03 – Coniston residence on the 3rd July 2017. This level 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 blast (Saros, 2018). A total of 15 events were identified as having a peak overpressure level exceeding the compliance criteria (Table 18) This data was then analysed to determine whether the cause was blast related or related to localised environmental factors.

Table 13: Blasting Impact Exceedances

Monitoring Location	Date	Time	Level		Compliance Limit	Comments
			PPV mm/s	O' Press dB(L)		
BM01 - Gumbelah Residence	12/02/2017	12:32:19	0.12	97.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	12/02/2017	12:32:19	0.13	106.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	12/02/2017	12:32:19	0.11	109.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	12/02/2017	12:32:19	0.06	110.6	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	26/02/2017	12:30:03	0.09	103.5	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM01 - Gumbelah Residence	9/04/2017	12:28:41	0.08	100.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	9/04/2017	12:28:41	0.10	104.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/04/2017	12:28:41	0.06	110.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	9/07/2017	12:30:36	0.1	102.8	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	9/07/2017	12:30:36	0.02	95.9	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM02 - Hillgrove Residence	27/08/2017	15:06:56	0.1	109.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	27/08/2017	15:06:56	0.06	112.3	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM03 - Coniston Residence	29/10/2017	12:45:45	0.13	101.0	95dB(L) - Sundays' and Public Holidays	Likely blast related.
BM02 - Hillgrove Residence	26/11/2017	12:31:27	0.11	101.0	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.
BM08.1 - Cowal North	26/11/2017	12:31:27	0.06	104.2	95dB(L) - Sundays' and Public Holidays	Not blast related, Localised enviromental factors likely.

Notes: PPV – peak particle velocity.

Of the 15 events that exceeded compliance levels, only one of these was assessed to be related to blasting practices, with the other 14 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. All of the exceedances identified at blast times were related to the Sundays' and Public Holidays' compliance limit of 95 dB(L).

Out of a total of 194 blasts during the reporting period:

- no blast related events exceeded the maximum compliance level of 120dB(L);
- no blast related events exceeded the 115dB(L) level on normal weekdays and Saturdays; and
- a total of one event or 0.52% of the total blasts exceeded the 95dB(L) level on Sundays and Public Holidays. and

The CGO achieved compliance in relation to the specified air overpressure levels for the reporting period.

Community Complaints

During the reporting period there were two community complaints received in relation to blasting:

- The blast occurring on 23 May at 12:31:51 was analysed due to a community complaint. After analysis, a peak overpressure level of 100.0dBL was recorded at the sensitive receptors (Hillgrove Residence – BM02), and was found to be below the compliance level of 115dBL. Vibration levels were below perceptible levels (less than 0.13mm/s).
- The blast occurring on 14 August at 15:02:23 was analysed due to a community complaint. After analysis, a peak overpressure level of 111.8dBL was recorded at the sensitive receptors (Gumbelah Residence – BM01), and was found to be below the compliance level of 115dBL. Vibration levels were below perceptible levels (less than 0.13mm/s).

Comparison with EIS Predictions

Blasting monitoring results during the reporting period are consistent with previous years and with the predictions detailed in the *Cowal Gold Operations Mine Life Extension Modification Environmental Assessment* (Evolution, 2016) 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.
- 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. As required by Development Consent condition 6.4(e), the Noise Management Plan (NMP) was approved by the DP&E on 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.

6.3.3 Environmental Performance

6.3.3.1 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, Lakeview III	39
Bramboyne, The Glen and Caloola	38
Lakeview, Foxham Downs II	37
All other privately-owned land	35

As at the end of the reporting period, Evolution had 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, Lakeview, Lakeview III, The Glen, Caloola and Foxam Downs II properties recorded during the reporting period (Spectrum Acoustics, 2017a, 2017b, 2017c, 2017d).

Table 15: Summary of Attended Noise Monitoring Results

Property	January 2017	June 2017	August 2017	November 2017
Laurel Park	D - <20, <20	D - <20, 22	D - <20, <20	D - 23, 22
	E - <20, <20	E - 22, 22	E - <20, <20	E - <20, <20
	N - <20, <20	N - 20, 21	N - 20, 21	N - <20, <20
Lakeview III	D - <20, <20	D - 26, 25	D - 27, 25	D - <20, <20
	E - <20, <20	E - 21, 21	E - <20, <20	E - <20, <20
	N - <20, <20	N - 26, 26	N - <20, <20	N - <20, <20
Bramboyne	D - <20, <20	D - 20, 20	D - <20, <20	D - <20, <20
	E - <20, <20	E - 21, 22	E - <20, <20	E - <20, <20
	N - <20, <20	N - 25, 24	N - <20, <20	N - <20, <20
The Glen	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
Calooa	D - <20, <20	D - <20, <20	D - 29, 28	D – <20, <20
	E - <20, <20	E - 22, 22	E - <20, <20	E - <20, <20
	N - <20, <20	N - 26, 25	N - <20, <20	N - <22, <24
Lakeview	D - <20, <20	D - 24, 23	D - 22, 20	D - <20, <20
	E - <20, <20	E - 23, 23	E - <20, <20	E - <20, <20
	N - <20, <20	N - 25, 25	N - <20, <20	N - 23, 23
Foxham Downs II	D - <20, <20	D - 30, 30	D - <20, <20	D - <20, <20
	E - <20, <20	E - 23, 23	E - <20, <20	E - <20, <20
	N - <20, <20	N - 23, 23	N - <20, <20	N - 22, 23

Source: Spectrum Acoustics (2017a, b, c, d).

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

6.3.3.2 Performance Outcomes

Attended noise monitoring results for all the 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'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).

6.3.4 Reportable Incidents

There were no reportable incidents during the reporting period.

6.3.5 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 the 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 during the reporting period 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 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 landscape 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, as required.	• 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 RMP, the BOMP and MOP (with reporting in the AR).	• Repair any significant erosion or washout areas. • Control of invasive weed species in accordance with the Land Management Plan. • 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.

BOMP – Biodiversity Offset Management Plan.

6.4.2.3 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).

The CGO's Erosion and Sediment Control Management Plan (ESCMP) was originally approved in September 2003 by the then NSW Department of Planning, with subsequent addenda dated December 2004, December 2009 and February 2015 prepared to the satisfaction of the Secretary.

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 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.
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.

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

Project Development	Control Strategy/Management Measure
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 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, 2017a).

6.5.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.5.5 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.

6.6.3 Environmental Performance

6.6.3.1 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.

6.6.3.2 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	61	2.4	15.1
Twice daily	February	52	0.7	11.0
Twice daily	March	54	0.5	19.4
Twice daily	April	60	3.6	14.6
Twice daily	May	57	1.1	15.1
Twice daily	June	46	4.8	17.3
Twice daily	July	57	0.2	13.6
Twice daily	August	62	1.0	13.4
Twice daily	September	53	0.6	10.8
Twice daily	October	62	2.3	12.0
Twice daily	November	60	0.9	13.5
Twice daily	December	56	0.2	10.4

6.6.4 Reportable Incidents

There were no reportable incidents during the reporting period.

6.6.5 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 Flora and Fauna Management Plan (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 RMP 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 RMP during the reporting period.

Flora monitoring was conducted during the reporting period in accordance with the RMP, 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

In 2017, rainfall was below monthly averages throughout most of the year, except in March and July; and almost no rainfall was recorded in June or September. In October and November monthly rainfall was slightly above monthly averages which promoted some germination and re-sprouting of very stressed perennial vegetation. During the reporting period, with the inundation of the lake, only two CW monitoring sites (CW3 and GW1) were accessible.

In 2016 and 2017, the lake monitoring sites suffered long periods of inundation resulting again in the death of ground cover species. During the reporting period the lake water had partially receded from CW3, and fully receded from GW1. Subsequently there were scattered seedlings and other ground covers establishing on the otherwise bare lake sediments. There were fewer plants recorded in CW3 (37 species), while more species were recorded in GW1 (44 species). In 2017, native ground covers continued to be more dominant than exotics and these had increased to provide 85 and 91% of the live plant cover respectively.

During the reporting period, there were 23 species common to both monitoring sites, which included five exotic species. Species from the families Asteraceae, Polygonaceae and Poaceae were quite common. Common exotic annuals recorded this year were *Aster subulatus* (Wild Aster), *Conyza* spp. (Fleabane), *Abutilon theophrasti* (Chinese Lantern), *Solanum nigrum* (Blackberry Nightshade) and *Lolium rigidum* (Wimmera Ryegrass).

No species was sufficiently abundant to meet the minimum criteria in CW3 this year. In GW1 the most abundant species continued to be the native perennial grass *Eragrostis australasica* (Canegrass).

Pilularia novae-hollandiae (Austral Pillwort) Habitat

During the reporting period, all gilgais inspected were completely dry as a result of the prolonged dry conditions experienced throughout most of the year, despite some localised flooding just prior to the surveys. There was limited active plant growth and floristic diversity was very low, with most of the persisting plants being very stressed. Slightly higher than average monthly rainfall was received in October and November, resulting in a flush of active plant growth. Some moisture dependent species had recently germinated or re-sprouted in the large and deeper gilgais on the grey clay soils that contained limited litter or plant cover. During this reporting period, no Austral Pillwort were located (DnA Environmental, 2017c).

Remnant Vegetation Enhancement Program (RVEP)

Six RVEP sites were assessed in 2017 and these were RVEPHill01, RVEPHill02, RVEPHill03, RVEPHill04 (located within RVEP Area 1), RVEP3 and RVEP4. The monitoring of the RVEP sites is undertaken as a simplified version of the annual rehabilitation monitoring program and did not include Landscape Function Analyses or soil analyses (consistent with the methodology applied since 2008).

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.

The lowest numbers of native species were recorded in the regrowth woodlands in Hill01 and Hill03, which had 11 and nine native species this year respectively. In RVEP3 there were 24 native species and in RVEP4 there were 20 native species recorded. The highest number of exotic species were recorded in RVEP3 and RVEP4 with 12 and 10 exotic species recorded respectively. There were fewer exotic species in the Hill01, Hill02 and Hill04 woodland sites and none were recorded in the Hill03 site during this reporting period.

In 2016, the lake and lake foreshore sites suffered long periods of inundation resulting in the death of many tree and shrub seedlings and most ground cover species, particularly if they were less than 2.0m in height. In 2017, the lake water had receded from most of the lake foreshore areas leaving persisting eucalypt saplings (>2.0m) and there was another extensive wave of eucalypt regeneration and other seedlings and ground covers that were establishing on the bare lake sediments where the water had recently receded.

The monitoring program in combination with permanent photo points and general area photographs have typically shown a marked improvement in tree health in most areas around the Lake Cowal environment, including those on Evolution-owned land. Up until 2016 there has been a noticeable increase in growth and vigour of the perennial ground covers and regenerating shrubs within the woodland areas and around scattered paddock trees, especially on the Hillgrove property and the protected areas on the Lakeside and Lake Cowal properties.

The particularly dry conditions throughout 2017 has resulted in a decline in ground covers and floristic diversity in most terrestrial sites, with these being compounded by an increase in grazing pressure. Persistent and heavy utilisation of macropods especially in the remnant woodland on Fellman's Hill has continued to have an impact on the condition of the vegetation with these being most noticeable in the Hill01 and Hill03 sites.

Vegetation Clearance

Several campaigns of vegetation clearance activities were undertaken during the reporting period, including:

- Approximately 30 ha in April 2017, to allow for topsoil stockpiles in the north of ML1535.
- Approximately 34 ha in May 2017, to allow for the construction of the basal layer for the NWRE extension.
- Approximately 6 ha in December 2017, to allow for stockpiles to the east of the TSFs.
- Other minor clearances for ancillary infrastructure and stockpiles within ML 1535.

All clearance works were undertaken consistent with the requirements of the VCP.

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 subsequent Environmental Assessments and approvals. The BOMP was approved by the DP&E on 10 September 2015.

Monitoring and management of the biodiversity offset areas continued in accordance with the requirements of the BOMP and the Development Consent 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 offsets;
- objectives for the offsets;
- 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 2017, and was undertaken consistent with the recommendations of the 2017 Independent Environmental Audit (Section 10).

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 2017 and subsequently granted by the DP&E on 30 June 2017. 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

In 2017, biodiversity offset monitoring was undertaken by DnA Environmental (2017a). A summary of the results from this monitoring survey are outlined in the sections below.

Northern Offset Area

The Northern Offset Area (NOA) contains approximately 74 ha of Weeping Myall Woodland Endangered Ecological Community (EEC) listed under both the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act) and the NSW *Biodiversity Conservation Act, 2016* (BC Act) and approximately 1 ha of Grey Box Woodlands EEC listed under the EPBC Act.

The *Acacia pendula – Casuarina cristata* reference sites occurring on flat to gently undulating slopes (RSlopes) contained some large bare areas which are often typical of these communities due to intense competition from the trees (allelopathy), frequent inundation (in favourable years) particularly in the gilgais, and often hard scalded clay pans. There continued to be high levels of ground cover in RSlope01 but a declining trend was emerging in RSlope02 as heavy grazing pressure by resident macropods have had a severe impact on the vegetation cover. This is combined with intense tree competition that has resulted in large areas of exposed soil, but the level of cover has improved this year. Grazing was not a significant issue and there was 100% functional patch area in all three sites.

The stability in the reference sites has typically changed as a result of the climatic conditions, and in dry times is compounded by increased grazing pressure by resident macropods. This year the prolonged dry conditions resulted in low covers of live ground cover plants. The stability, infiltration and nutrient recycling capacity in the offset sites have also changed in response to the changing climatic conditions and most have also shown a marginal decline in stability this year. Nonetheless, all offset sites had a stability, infiltration and nutrient recycling capacity that were comparable to or exceeded the local Myall woodlands.

Species diversity in the offset sites followed a similar trend to the reference sites with changes strongly correlated with the changing seasonal conditions. In 2010 the water filled gilgais were a particularly important feature in these sites and while they have largely been dry at the time of monitoring since then, they continued to provide topographic relief and additional habitat features. This year the prolonged dry conditions have resulted in a reduction in floristic diversity across the range of monitoring sites. Compared to the reference sites, all offset sites had an adequate total species diversity but native species diversity was low in NOA02. All sites had a high abundance and diversity of exotic species and were weedier than desired.

In the northern offset sites, there was an abundance of herbs and grasses and there were two reed species and a species of fern. Compared to the reference sites however, there was an absence of trees and shrubs in the NOA sites and there were a low number of sub-shrubs in all offset sites.

The soils in the offset sites had a similar chemistry as the reference sites or were within desirable agricultural levels, except that all sites were deficient in organic matter. The soil EC in both reference sites exceeded the desirable agricultural level of 0.150 dS/m and were slightly to moderately saline, while in all offset sites the soils were non saline. RSlope02 has high ESP indicating the soils can be naturally sodic. This year the ESP in NOA01 and NOA02 have significantly increased and were well above the sodic threshold, but these were characteristic of the local woodlands.

The soil analysis results indicate that there were elevated levels of calcium, magnesium, potassium, manganese, iron, copper and arsenic in the offset sites. These elements were also recorded in elevated levels within the reference sites suggesting that these elements can occur at naturally high levels within the undulating slopes around Lake Cowal. For example in the reference sites, there were up to five times higher concentrations of calcium and magnesium than the recommended levels.

Southern Offset Area

The Southern Offset Area (SOA) contains approximately 48 ha of Weeping Myall Woodland EEC listed under both the EPBC Act and the BC Act, and approximately 149 ha of Grey Box Woodlands EEC listed under the EPBC Act.

The SOA monitoring sites are situated in old cropping paddocks and have become very stable due to the relatively high levels of litter derived from dead annual plants and very hard compacted soils. In October 2016, site SOA02 was sprayed into ~1m wide strips and planted with tubestock, however this had little effect on the functional capacity of the site. While there continued to be low perennial vegetation and cryptogam cover, there was an increased cover of litter in SOA01 this year. There was an increase in annual and perennial vegetation in SOA02. In SOA03 and SOA04 recent heavy grazing pressure resulted in a lower cover of litter and perennial plants. Compared to the reference sites all SOA monitoring sites had a comparable stability, but typically infiltration and nutrient capacities were low.

Native species were more diverse than exotic species in all sites. All sites had an acceptable diversity of native species but the diversity of exotic species was too high. None of the offset sites yet had an acceptable abundance cover of native ground cover plants. The SOA sites contained an acceptable diversity of most growth forms compared to the local woodlands. There were however a low diversity of tree and shrub species in SOA01. There was also a low diversity of sub-shrubs in SOA03 and SOA04.

All SOA monitoring sites except SOA02 had a soil pH that fell within desirable agricultural levels and organic matter and nitrate levels were low in all sites. Sites SOA02 and SOA04 had high ECs compared to the reference site but the soils were non saline. In sites SOA01 and SOA02 the soils were sodic, and in SOA02 CEC was elevated.

In the SOA there were elevated levels of magnesium, potassium, manganese, silicon and arsenic with many of the elements also occurring in elevated concentrations in the reference sites suggesting they naturally occur in high levels within the ridges and hills in the Lake Cowal environment. There were also high concentrations of iron in all of the SOA monitoring sites, especially SOA01. Significantly high iron concentrations were also recorded in all of the reference sites, with concentrations up to 10 times higher than recommended guidelines. There may also have been slightly elevated concentrations of calcium, zinc, copper and silicon in some sites.

In terms of meeting completion targets there was an obvious lack of tree and shrub species and associated structure and habitat requirements in all SOA monitoring sites. Despite the tree planting in SOA02 in 2016, mortality was high and shrub and juvenile tree targets were slightly too low this year.

The proposed revegetation activities across the SOA revegetation areas on the western side of Fellmans Hill should show an improvement in ecological performance providing appropriate species and planting 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 RMP during the reporting period.

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, RMP 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;
- management of impacts on terrestrial and aquatic fauna;
- rehabilitation of disturbance areas;
- weed management and pest control;
- 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:

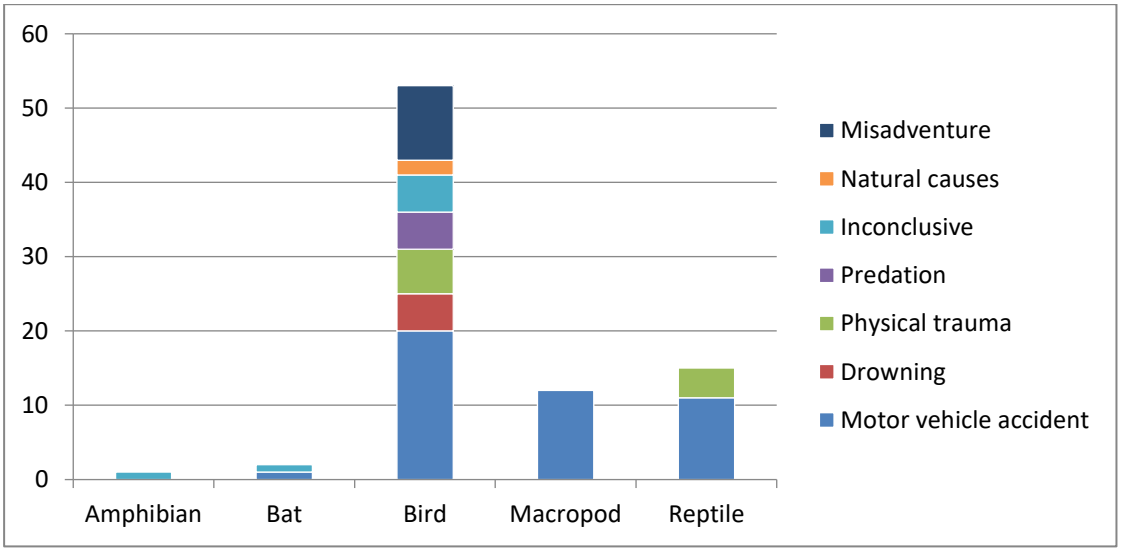
- continuation of long-term monitoring of bird breeding;
- bat call monitoring at the active TSF and control site;
- twice daily monitoring of any fauna usage of the TSFs;
- weekly boundary inspections of ML 1535;
- regular checking of the main diesel tank and hydrogen peroxide tank concrete bund sumps 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 83 fauna incidents on ML 1535 during the reporting period. All injured or deceased fauna were taken to the local vet for examination as required. Over half 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 (2017a, 2017b, 2017c) during the reporting period is provided below. The location of waterbird monitoring transects are presented on Figure 8.

January 2017

The first survey for 2017 was carried out on 24th and 25th of January 2017. The water levels in the Lake had receded since the extremely high levels observed in the previous survey (i.e. during 2016). In November 2016 the lake water was so high it had inundated the lignum stands in the north and west of the lake impacting on the availability of nesting habitat for birds (Gell, 2017a).

A total of 36 species were observed along the transects, the second highest recorded number for a January survey since refilling of the Lake in 2010.; although it is noted the number of individuals recorded was only 2,267 birds, which was the second lowest January tally over the last 4 years. Transect 7 supported the greatest number of species, while transect 8 the greatest number of birds.

The most commonly recorded species were Grey Teal (137), Australian Wood Duck (486), Eurasian Coot (481), White-necked Heron (162), Australian White Ibis (145), Silver Gull (107) and Whiskered Tern (138). The birds at Lake Cowal were no longer so dominated by ducks with the eight species representing only ~ 31% of all birds recorded. This survey witnessed a rise in the number of fish-eating species which included Australian Pelican, Darter, cormorants, egrets, herons and Whiskered Tern.

August 2017

Lake Cowal was visited on 30 and 31 August 2017, during which the Lake was observed to remain full. While Grey Teal, Australian Wood Duck and Eurasian Coot still dominated the bird assemblage, several birds recorded in high numbers in January 2017 were not recorded again in this survey (e.g. Magpie Goose, White-necked Heron, Australian White Ibis and Whiskered Tern). However, it is noted that this is not unusual for the August survey.

At the observed lake level during the August 2017 surveys, the areas of shallow margins were small, providing only limited habitat for wading birds (stilt, avocets) and dabbling duck species. Despite this survey being late in August few ducklings were observed. Also, no ibis were observed suggesting that colonial breeding was yet to commence (Gell, 2017b).

The most commonly recorded species during the August 2017 survyes were Grey Teal (308), Pink-eared Duck (135), Australian Wood Duck (156) and Eurasian Coot (295) that represented ~81% of all birds observed. The birds at Lake Cowal were dominated by ducks representing ~ 58% of the birds recorded.

October/December 2017

Lake Cowal was visited on October 30th and December 8th, 2017. Water levels remained high, but continued to recede.

Similar to the surveys in August, it was observed that at this lake level the areas of shallow margins were limited restricting the number of wading birds (stilt, avocets) and dabbling duck species. During these surveys, narrow zones of mudflats were evident around the lake margins providing habitat for these wading species, mostly at transect 7 which has a shallower offshore profile.

The boat survey of the northern lake revealed limited breeding activity, mostly of Darter. While several ibis nests were observed, the activity was much less than at previous times when the lake is high. As in the past, the declining lake level, not its actually depth, appears to suppress breeding behaviour.

A total of 33 species were observed along transects. The total of 1121 birds is similar to that of the previous survey (August 2017) marking a period of low bird numbers. Transect 7 supported the greatest number of species and the greatest number of birds. In particular, transect 7 supported several wading species that were mostly absent at the other transects. The most commonly recorded species were Grey Teal (218), Australian Wood Duck (256) and Whiskered Tern (326) and these represented 71% of all birds observed. The total of 33 species was the same as in November 2016 while 1,121 birds was the lowest tally for a spring survey since 2010.

Fauna Monitoring of TSFs and ML 1535 Boundary

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

The main findings 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.
- 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 biodiversity 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 biodiversity 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 biodiversity 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 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 Outcomes

Weed Management

During the weed survey undertaken during the reporting period, nine noxious weeds were recorded, including one Priority Weed and either weeds of concern (NGH Environmental, 2017).

During the 2017 survey, one Priority Weed in the Riverina Local Land Services Area was recorded, namely African Boxthorn (*Lycium ferocissimum*) (NGH Environmental, 2017).

Scattered individuals of African Boxthorn (Lycium ferocissimum) were observed during the reporting period on a number of transects. These were mainly isolated plants under mature trees, with occasional heavier infestations. Based on the comparison of transects from 2017 and 2016, it is likely that the African Boxthorn has increased with the establishment of newer plants and persistence of previously identified ones. Some of the transects which previously had African Boxthorn did not have them in 2017. However, follow up maintenance of these transects will still be necessary as it is likely seed sources will still be in the area. Evidence of treatment of African Boxthorn was also apparent during the reporting period, with many dead African Boxthorn shrubs observed (NGH Environmental, 2017).

Eight additional species listed as weeds of concern in the Riverina area were identified during the surveys (NGH Environmental, 2017) in various quantities and locations, including:

- Bathurst Burr (*Xanthium spinosum*).
- Caltrop (*Tribulus terrestris*).
- Galvanised Burr (*Sclerolaena birchii*).
- Horehound (*Marrubrium vulgare*).
- Lippia (*Phyla canescens*).
- Scotch Thistle (*Onopordum acanthium*).
- St Barnaby's Thistle (*Centaurea solstitialis*).
- St John's wort (*Hypericum perforatum*).

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

Development Consent Condition 3.1(a)(ii) outlines the requirements in relation to salvage, excavation and monitoring of archaeological sites within the CGO area prior to and during development. An Indigenous Archaeology and Cultural Heritage Management Plan (IACMP) has been prepared and approved for the CGO.

Monitoring and management of Aboriginal objects and archaeological sites 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 land disturbance.

During the reporting period, a total of six registered sites were remaining within the ML 1535 boundary. Registered Sites (exposures) D 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:

- Numerous cultural heritage and due diligence inspections with archaeologist and representatives from the Aboriginal community.
- Archaeological salvage activities (including the management of sites ‘Wamboyne Back Plains 1’, B, C and E) with archaeologists and representatives from the Aboriginal community.

It is noted that 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, due diligence inspections were undertaken within proposed exploration areas within ML 1535.

6.11.2.2 Performance Outcomes

No non-compliance issues were reported.

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.

6.13 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.

6.13.1 Environmental Management

6.13.1.1 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.

6.13.1.2 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

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

6.13.2.2 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.

6.13.3 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 BUSHFIRE

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

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

6.14.1 Environmental Management

6.14.1.1 Control Strategies

In accordance with the RMP 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.

6.14.1.2 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

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.

6.14.2.2 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.

6.14.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.14.4 Further Improvements

No further improvements are proposed for the next reporting period.

6.15 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.

6.15.1 Environmental Management

6.15.1.1 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, 2017), 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.

6.15.1.2 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

6.15.2.1 Monitoring

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

6.15.2.2 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.

6.15.3 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.

6.16 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.

6.16.1 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.

6.16.1.1 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.

6.16.1.2 Effectiveness of Control Strategies

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

6.16.1.3 Variations from Proposed Control Strategies

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

6.16.2 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. 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.

6.16.3 Reportable Incidents

There were no reportable incidents during the reporting period.

6.16.4 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	-	1,940.8	1,940.8
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)	-	323.0	323.0
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	465.9	205.7	671.6
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.	-	0.1	0.1
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 1,940.8 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 DI-Lands & 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 323.0 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.

An open pit dewatering borefield has been established external to the perimeter of the open pit. A total of 671.6 ML was extracted from the open pit dewatering sump (which collectd 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 0.1 ML was pumped from the Jemalong Irrigation Channel during the reporting period. 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 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.

7.2.2 Environmental Management

7.2.2.1 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.

7.2.2.2 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.

7.2.2.3 Variations from Proposed Control Strategies

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

7.2.3 Environmental Performance

7.2.3.1 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.

7.2.3.2 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 likely due to changes in the standing water level within the ponds. pH results were the most stable throughout the reporting period, and ranged from 6.7 to 9.81 across the on-site surface water ponds. EC ranged from 127 to 69,700 microSeimens per centimeter (µS/cm) and TSS ranged from <1 to 5540 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 generally 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 Monthly and Quarterly Surface Water Monitoring Results for the Reporting Period

Monthly Surface Water Monitoring - D1, D4, UCD North and UCD South				
Dam D1	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	22	6.5	10.1	8.3
Electrical Conductivity - Field (µS/cm)	22	1542	16060	6629
Total Suspended Solids (mg/L)	22	2	325	48
Dam D4	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	6	6.9	8.5	7.7
Electrical Conductivity - Field (µS/cm)	6	365	69700	12946
Total Suspended Solids (mg/L)	6	11	5540*	1026
UCD North	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	23	7.42	8.76	8.0
Electrical Conductivity - Field (µS/cm)	23	155	638	390
Total Suspended Solids (mg/L)	24[+]	28	309	95
UCD South	**COUNT**	**MIN**	**MAX**	**MEAN**
pH – Field	22	7.8[#]	9.1[#]	8.6[#]
Electrical Conductivity - Field (µS/cm)	22	127[#]	3910[#]	1064[#]
Total Suspended Solids (mg/L)	22	27	1940	155
Quarterly Surface Water Monitoring – D2, D3, D8B, D9, D6, D5 and Pit Sumps				
Dam D5	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	5	7.6	8.1	7.9
Electrical Conductivity - Field (µS/cm)	5	5720	40200	19438
Total Suspended Solids (mg/L)	5	14	139	56
Dam D6	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	6	7.1	7.9	7.4
Electrical Conductivity - Field (µS/cm)	6	16690	33800	24822
Total Suspended Solids (mg/L)	6	2	139	32
Pit Sump 1	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	12	6.7	9.8	7.5
Electrical Conductivity - Field (µS/cm)	12	11530	56700	39969
Total Suspended Solids (mg/L)	12	3	290	34
Dam D2	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.1	8.2	7.7
Electrical Conductivity - Field (µS/cm)	4	21740	32400	26035
Oil & Grease (mg/L)	4	< 5	< 5	< 5
Dam D3	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.2	8.0	7.7
Electrical Conductivity - Field (µS/cm)	4	24100	49500	35898
Oil & Grease (mg/L)	4	< 5	< 5	< 5

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

Dam D9	COUNT	MIN	MAX	MEAN
pH - Field	4	7.5	8.1	7.8
Electrical Conductivity - Field (µS/cm)^	4	22000	24000	23155
Total Suspended Solids (mg/L)	3[$]	<1	4	4
Oil & Grease (mg/L)	4	< 5	< 5	< 5
Dam D6	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	6	7.12	7.86	7.42
Electrical Conductivity - Field (µS/cm)^	6	16690	33800	24822
Total Suspended Solids (mg/L)	6	2	139	32
Dam D8B	**COUNT**	**MIN**	**MAX**	**MEAN**
pH - Field	4	7.8	8.4	8.2
Electrical Conductivity - Field (µS/cm)^	4	9670	15140	11925
Total Suspended Solids (mg/L)	3[$]	38	119	86

^ Dam D9 was used as storage for water collected from surface water runoff dams after heavy rain.

[#] Lab data reported for July 2017 monitoring period as field data unavailable.

* Dam 4 – Comment water level very low and muddy.

[+] Extra lab sample collected 24/04/17 – Therefore no field data but extra TSS sample point.

[$] Only pH and EC tested in the lab, TSS not tested for.

UCD North, which collects upstream water flowing through the diversion channel around the perimeter of the closed catchment remained inundated throughout 2017, following the 2016 flooding of Lake Cowal. Therefore sampling results are reflective of lake water quality rather than diversion water. UCD South was not inundated in 2017 and results are reflective of diversion runoff.

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 were generally stable throughout the reporting period and ranged from 7.42 to 9.14 across both ponds.

EC ranged from 127.4 to 3,910 µS/cm and TSS ranged from 22 to 1940 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. The 1940 mg/g TSS result cam from November sampling when the level was very low and muddy, the next highest reading is 309 mg/L.

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.

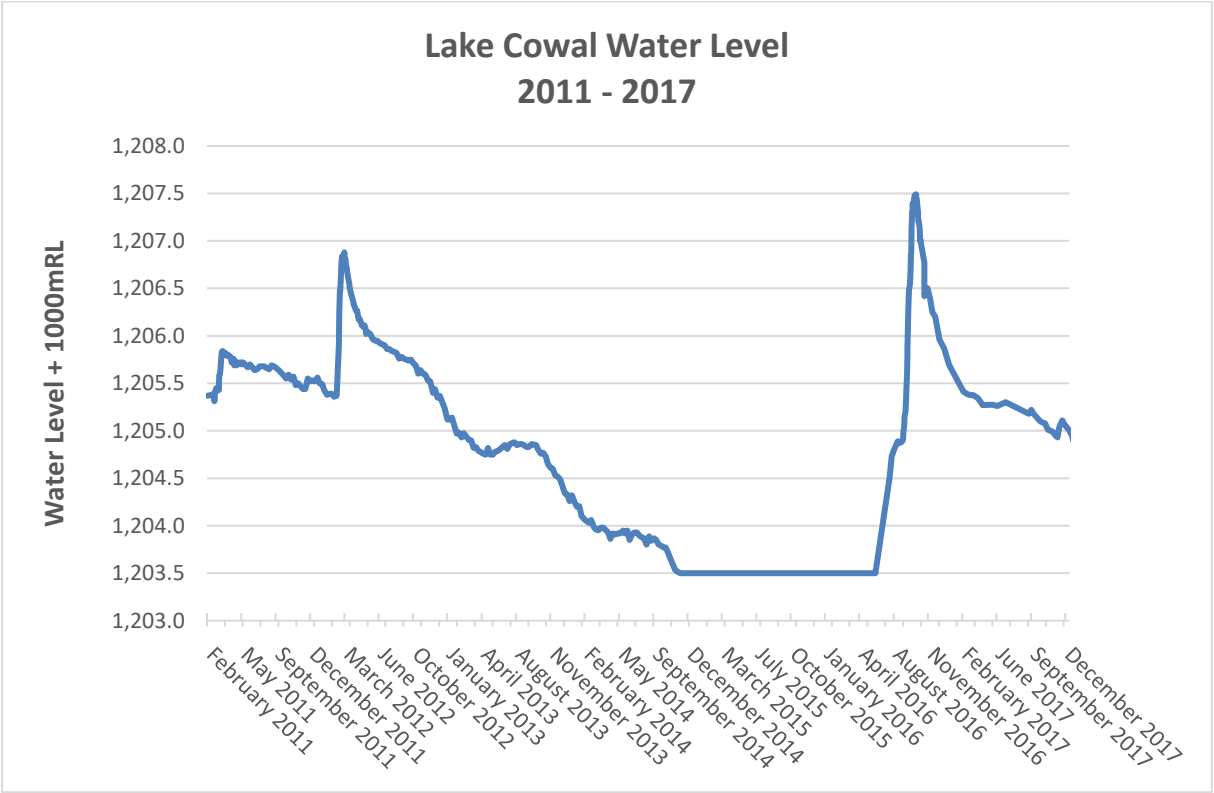
Lake Cowal

During the reporting period, Lake Cowal remained completely inundated following high rainfall events in 2016 and subsequent flooding of the Lachlan River and Bland Creek (Plate 2).

Lake Cowal peaked at a height of 207.49 m RL on 10 October 2016, before steadily receding back to 205.007 m RL by the end of 2017 (Graph 2).

Plate 2: Aerial Photograph of the Lake Protection Bund

Graph 2: Lake Cowal Water Level 2011 - 2017



Lake Cowal Water Quality

Water quality monitoring at Lake Cowal was undertaken by DM McMahon Pty Ltd, including a detailed description and interpretation of the results. Key summaries of the lake water monitoring results (DM McMahon, 2017) are provided in the subsections below.

A comparison of the 2017 Lake Cowal water quality results against the ANZECC and ARMCANZ (2000) default trigger values for surface water (lakes) indicates that the 2017 monitoring results (totals and dissolved) are below or marginally above the default trigger values. Heavy metal readings are similar to historical data. Overall, the pH and EC is within the range of values previously recorded.

A comparison of the 2017 CGO lake sediment results against the ANZECC and ARMCANZ (2000) trigger values indicates the results were all below the recommended default trigger values, apart from total Antimony. These results are generally consistent with historical data.

pH and Electrical Conductivity

pH results ranged from 7.12 to 8.44 with a mean of 7.88. 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 2011 results (Table 22).

EC results ranged from 299 to 511 µS/cm with a mean of 409 µS/cm which is mid-range compared to 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).

Turbidity and Suspended Solids

Turbidity results ranged from 26.7 to 640 mg/L NTU with a mean of 361 mg/L which is generally above the baseline data from 1991 – 1992. 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. These results are well above 2010-2012 values and are similar to upper values recorded in 2013 to 2016.

The suspended solids results ranged from 24 to 650 mg/L with a mean of 361 mg/L which is above the 2010-2014 and 2016 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 0.04 to 15.97 mg/L with a mean of 9.4 mg/L which are similar to the 2011 – 2014 results but above the 2010 and 2016 results.

Heavy Metals (total and dissolved)

The mean results for dissolved heavy metals for 2013 are generally higher than the ANZECC and ARMCANZ (2000) default trigger values. The mean 2014 results for dissolved heavy metals are slightly higher than the mean baseline results recorded in 1991-1992 and the results from the 2010 monitoring round, both of which were above ANZECC and ARMCANZ (2000) values.

The mean 2014 monitoring results for total heavy metals marginally exceeded ANZECC and ARMCANZ (2000) default trigger values for Arsenic, Nickel, Lead and Zinc, as was the case in 2011 and 2012 for Lead and Zinc and in 2013 for Nickel. The mean 2016 monitoring results 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.

The mean 2017 monitoring results for total heavy metals again exceeded the ANZECC and ARMCANZ (2000) default trigger values for Nickel, Lead and Zinc which is a continuation of results from previous years (DM McMahon, 2017).

Table 22: Summary of Lake Cowal Water Monitoring – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) 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)	44 – 356 (160)	102 – 192 (140)	NA	NA
Suspended Solids (mg/L)	6 - 192	5 – 184 (38)	7 – 274 (67)	66 – 472 (216)	57 – 556 (233)	13 – 417 (145)	24 – 650 (361)	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)	7.05 – 8.76 (7.8)	7.12 – 8.44 (7.88)	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)	119 – 1350 (583)	299 – 511 (409)	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)	57 – 644 (366)	26.7 – 640 (360.6)	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)	0.08 – 8.57 (6.46)	0.04 – 15.97 (9.4)	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)	11.7 – 27.3 (18.3)	7.6 – 29.2 (16.7)	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)	0.8 – 4.5 (2.6)	0.6 – 3.1 (1.64)	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	204.88 – 207.45	204.93 - 205.86	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)	4.05 – 21.7 (14.81)	10.7 – 25.4 (16.6)	NA	NA (insufficient data)

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) 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)	8 – 41 (22)	15 – 30 (23)	NA	NA
Magnesium (mg/L)	10	6 – 12 (9)	4 – 14 (7)	9 – 17 (13.4)	16 – 32 (29)	4 – 32 (14)	9 – 20 (12)	NA	NA
Potassium (mg/L)	15	12 – 19 (15)	12 – 19 (14)	14 – 27 (21)	26 – 36 (31)	5 - 27 (15)	12 – 18 (16)	NA	NA
Sodium (mg/L)	19	13 – 35 (24)	12 – 38 (22)	35 – 59 (50)	105 – 168 (144)	9 – 164 (64)	27 – 43 (37)	NA	NA
Chloride (mg/L)	25	19 – 41 (28)	12 – 66 (22)	36 – 61 (51)	91 – 194 (155)	9 – 194 (77)	26 – 39 (34)	NA	NA
Sulphate (mg/L)	3	1 – 10 (2)	1 – 10 (4)	14 -38 (21)	29 – 37 (33)	1 - 37 (16)	6 – 15 (8)	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)	1.35 – 12.4 (5.4)	3.09 – 5.4 (4.13)	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)	0.35 – 13.2 (5.40)	3.00 – 5.11 (3.93)	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)	0.002 – 0.02 (0.00748[3]) (total)	<0.001 – 0.01 (0.005) (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)	0.0001 – 0.014 (0.00561[3]) (dissolved)	0.003 – 0.006 (0.0045) (dissolved)	0.0016[3] (dissolved)	
	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)	0.001 – 0.004 (0.0019[3]) (dissolved)	<0.001 -0.003 (0.0012) (dissolved)	NA	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) 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)	0.0001 – 0.0002 (0.0001[3]) (total)	0.0001 – 0.0002 (0.0001) (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)	0.0001 – 0.0001 (0.0001[3]) (dissolved)	<0.0001 – <0.0001 (<0.0001) (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)	0.001 – 0.003 (0.0016[3]) (total)	<0.001 – 0.002 (0.001) (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)	0.001 – 0.004 (0.0019[3]) (dissolved)	<0.001 -0.003 (0.0012) (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)	0.004 – 0.025 (0.015[3]) (total)	0.009 – 0.021 (0.0147) (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)	0.002 – 0.007 (0.0052[3]) (dissolved)	0.002 – 0.02 (0.0032) (total)	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)	0.002 – 0.011 (0.0067[3]) (total)	0.003 – 0.06 (0.008) (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)	0.001 – 0.01 (0.0015[3]) (dissolved)	<0.001 – 0.01 (0.003) (dissolved)	0.0005[3] (dissolved)	

Table 22 (Continued): Summary of Lake Cowal Water Monitoring – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Cowal Water Quality Results (2017) 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)	0.001 – 0.05 (0.017[3]) (total)	<0.001 - <0.001 (<0.001) (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)	0.001 – 0.0001 (0.001[3]) (dissolved)	<0.001 - <0.001 (<0.001) (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)	0.006 – 0.047 (0.028[3]) (total)	0.015 – 0.045 (0.027) (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)	0.005 – 0.052 (0.014[3]) (dissolved)	<0.005 – 0.017 (0.0064) (dissolved)	0.00306[3] (dissolved)	

Source: DM McMahon, 2017.

Table 23: Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) 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	51 – 148 (78) [3]	131-131 (131)	NA	NA
Suspended Solids (mg/L)	14	11 – 201 (53)	23 – 372 (124)	210 – 640 (425)	NA	4 – 63 (31) [3]	77-77 (77)	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	7.09 – 8.31 (7.52) [3]	7.58-7.58 (7.58)	8.27 – 8.67	6.5 to 8.0
Electrical Conductivity (µS/cm)	178	126 – 348 (199)	89 – 871 (246)	365 – 551 (458)	NA	139 – 721 (262) [3]	435-435 (435)	222 – 1557 [1, 3]	20 to 30 µS/cm [1]
Turbidity (NTU)	116	31 – 807 (237)	18.6 – 693 (296)	337 – 2560 (1449)	NA	51 – 270 (122) [3]	357-357 (357)	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	2.6 – 16.1 (8.6) [3]	0.12-0.12 (0.12)	NA	NA
Calcium (mg/L)	9	3 – 15 (8)	5 – 23 (11.3)	10 – 29 (19.5)	NA	4 – 32 (15) [3]	21-21 (21)	NA	NA
Magnesium (mg/L)	5.5	2 – 9 (5)	3 – 16 (6.9)	6 – 15 (10.5)	NA	3 – 28 (8.4) [3]	13-13 (13)	NA	NA
Potassium (mg/L)	10.5	8 – 17 (12)	10 – 16 (12.6)	21 – 23 (22)	NA	2 – 9 (6.9) [3]	14-14 (14)	NA	NA

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) Ranges (Mean)	Lake Cowal Baseline Water Quality Results (1991 -1992)#	Aquatic Ecosystems^ ~
Sodium (mg/L)	15.5	11 – 34 (17)	14 – 45 (22.4)	48 – 51 (49.5)	NA	10 – 58 (20.4)[3]	50-50 (50)	NA	NA
Chloride (mg/L)	18	9 – 28 (18)	12 – 94 (31)	40 – 55 (47.5)	NA	5 – 128 (31.8)[3]	49-49 (49)	NA	NA
Sulphate (mg/L)	4.5	1 – 13 (5)[3]	2 – 11 (6.2)[3]	23 – 28 (25.5)[3]	NA	1- 27 (7)[3]	16-16 (16)	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	1.38 – 3.45 (2.1)[3]	4.65-4.65 (4.65)	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	1.38 – 6.65 (2.53)[3]	4.33-4.33 (4.33)	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	0.002 – 0.005 (0.0028)[3] (total)	0.006-0.006 (0.0060)	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	0.001 – 0.004 (0.0016)[3] (dissolved)	0.002-0.002 (0.002)	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	0.0001 – 0.0001 (0.0001)[3] (total)	0.0001-0.0001 (0.0001)	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	0.0001 – 0.0001 (0.0001)[3] (dissolved)	0.0001-0.0001 (0.0001)	0.00005[3] (dissolved)	

Table 23 (Continued): Summary of Lake Cowal Inflow Water Quality Results – 2010 – 2017

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 (2016) Ranges (Mean)	Lake Inflow Water Quality Results (2017) 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	0.001 – 0.001 (0.001)[3] (total)	0.001-0.001 (0.001)	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	0.001 – 0.001 (0.001)[3] (dissolved)	0.001-0.001 (0.001)	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	0.005 – 0.013 (0.0078)[3] (total)	0.014-0.014 (0.014)	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	0.001 – 0.006 (0.0039)[3] (dissolved)	0.004-0.004 (0.004)	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	0.001 – 0.006 (0.0029) (total)[3]	0007-0.007 (0.007)	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	0.001 – 0.002 (0.001)[3] (dissolved)	<0.001-<0.001 (<0.001)	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	0.001 – 0.001 (0.001)[3] (total)	<0.001-<0.001 (<0.001)	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	0.001 – 0.001 (0.001)[3] (dissolved)	<0.001-<0.001 (<0.001)	NA	
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	0.007 – 0.027 (0.014)[3] (total)	0.025-0.025 (0.025)	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	0.005 – 0.008 (0.0055)[3] (dissolved)	0.13-0.013 (0.013)	0.00306[3] (dissolved)	

Source: DM McMahon, 2017, North Limited (1998) and NSR Environmental Consultants (1995)

^ 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 Inflow Water Quality

Lake inflow water monitoring sites were accessible on one occasion, in October 2017. The 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 water monitoring sites. All mean heavy metal readings for 2017 were equal to or lower than the 2016 readings with the exception of nickel, lead and zinc which gave slightly higher 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 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 water monitoring sites (DM McMahon, 2017).

Lake Cowal Sediments

Of the 34 lake sediment sample sites specified only 26 were able to be sampled in 2017. Sites L9 to L13, Sandy Creek, Bland Creek, Lachlan Inflow and Irrigation Inflow were too shallow to access safely at that time.

Electrical Conductivity (EC)

EC results ranged from 46 to 184 µS/cm with a mean of 90 µS/cm. The overall mean for 2017 is lower than the 2012, 2013, 2014 and 2016 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 electrical conductivity trends will continue to be monitored at Lake Cowal.

A summary of the mean 2017 sediment monitoring results compared with the ANZECC and ARMCANZ (2000) trigger values and the 2010 to 2014 and 2016 mean monitoring results is provided in Table 24.

The mean heavy metals results for 2017 were very similar to the mean heavy metals results for 2010 – 2014 and 2016 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 Method Detection Limit [MDL]), which is above the ANZECC and ARMCANZ (2000) sediment trigger value (2 mg/L). However, as shown in Table 24, the 2017 mean Antimony results are consistent with the 2010 – 2014 and 2016 mean Antimony results.

7.2.4 Reportable Incidents

There were no reportable incidents during the reporting period.

7.2.5 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 (2016) Range (Mean)	Lake Cowal Sediment Results (2017) Range (Mean)	Aquatic Ecosystems^
Electrical Conductivity (µS/cm)	33 – 142 (94)	3 – 162 (99)	49 – 215 (94)	53 – 187 (105)	70 – 207 (133)	45 – 218 (105)	46 – 184 (90)	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)	1.6 – 5.8 (3.2)[1] (total)	1.3 – 5.6 (2.8) (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)	1 – 3.4 (1.7)[1] (extractable)	<1 – 3.4 (1.4) (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)	1 – 1 (1)[1] (total)	<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)	0.1 – 0.1 (0.1)[1] (extractable)	<0.1 - <0.1 (<0.1) (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)	5 – 18 (12.55)[1] (total)	7 – 22 (12) (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)	3.5 – 14.8 (8.09)[1] (extractable)	4.4 – 16.3 (8.4) (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)	11 – 39 (25.86)[1] (total)	11 – 37 (22) (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)	1.2 – 6.3 (2.83)[1] (extractable)	<1 – 10.5 (3.3) (extractable)	
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)	5 – 5 (5)[1] (total)	<5 - <5 (<5) (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)	1 – 2.2 (1.02)[1] (extractable)	<1 – 1.9 (1.1) (extractable)	

After: NSR Environmental Consultants (1995) and DM McMahon (2017).

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

[1] Mean value.

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 2017 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 a direct result of pumping for water supply and pit dewatering. From 2004 to 2017, water supply pumping has resulted in a maximum drawdown of approximately 64 m in the Bland Creek Palaeochannel 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 12 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 to further assess the change in groundwater level in this area (Coffey, 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, 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 (Coffey, 2011, 2011b and 2012). It was also assessed that groundwater level rises associated with the TSF are not expected to reach the ground surface (Coffey, 2009).

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

Groundwater Quality

Variations in groundwater chemistry can be due to natural conditions such as drought and biological activity, changes in groundwater level due to pit dewatering or water supply pumping, or possible anthropogenic inputs such as the introduction of cyanide in the gold extraction process. Possible reasons for changes in water quality are discussed below.

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 one of the seven Bland Creek Palaeochannel bores (BLPR2) and one of the monitoring bores in the TSF area (P417B). 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, suggesting the cause may be related to severe drought conditions between 2004 and 2010. Groundwater with higher TDS, 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 fall 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.

Fluctuations in pH, EC, sodium, sulphate and bicarbonate levels at MON01B to the east of the northern TSF may reflect a response to increased rainfall recharge over this period.

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. During the 2017 reporting period, total and WAD cyanide results were below the LOR (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). The RMP was revised to reflect Development consent as modified on 7 February 2017 and was approved by the DRG via the MOP approval on 16 October 2017.

As the currently approved RMP was not approved for the entire reporting period, the CGO was operated in accordance with the previously approved RMP for earlier part of 2017. In accordance with Development Consent Condition 2.4(c)(vii), the RMP 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 RMP.

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 143 ha at the end of the reporting period and is expected to increase by approximately 10 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 4 ha of the upper three batters on the eastern end, and to the middle batters of the remainder;
- NWRE – North Wall – applied topsoil to 2 ha on the middle batters;
- NWRE – North Wall – shaped, applied rock mulch and topsoil to 2 ha on the top six batters at the eastern end;
- NWRE – planted 1,500 tubestock within an approximate 4 ha area on the western end (over all 12 batters);
- NWRE – North Wall – direct seeded 0.5 ha on the top batter towards the middle;
- SWRE – North Wall – shaped rock and applied topsoil to approximately 6 ha;
- SWRE – South Wall – direct seeded 0.5 ha on the top batter towards the western 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 to the trial area (approximately 7 ha);
- SWRE – South Wall – reshaped, applied rock mulch, topsoil and gypsum to all batters east of the SWRE trial area further towards the east (approximately 3.6 ha);
- SWRE – South Wall – reshaped, applied rock mulch, topsoil and gypsum to top six batters (approximately 4 ha);
- Temporary Isolation Bund and Lake Protection Bund – road and weed maintenance; and
- PWRE – Inner Perimeter wall – reshaped and applied rock mulch to 90% of the area (approximately 7.8 ha).

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 (2016)	Current Reporting Period (2017)	Next Reporting Period (estimated) (2018)
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	151	143#	153
D	Land under active Rehabilitation	25	33	33
E	Completed Rehabilitation	0	0	0

Approximately 7.8 ha of land being prepared for rehabilitation was re-disturbed on the PWRE for the approved Stage H cutback.

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

Table 26 provides details of the nature of disturbance and the rehabilitation status for areas that have been disturbed up to and including the reporting period. Plate 3 shows the areas rehabilitated during the reporting period.

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 major building renovations or removal occurred during the reporting period, however some smaller minor construction works were undertaken including additional demountable structures and storage shipping containers.

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	✓	Complete	16	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	24	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	32	Not yet rehabilitated
STSF						
• Floor	✓	✓	✓	Complete	156	Not yet rehabilitated
• Downstream lift	✓	✓	✓	Complete	13	Shaped and covered
• Upstream lift	✓	✓	✓	Complete	24	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	32	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	40	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	48	Not yet rehabilitated
• Upstream lift	N/A	N/A	✓	Complete	56	Not yet rehabilitated
Open Pit	✓	✓	✓	Commenced	120	Not yet rehabilitated
PWE	✓	✓	✓	Commenced	60	All sections shaped and covered
NWRE (excluding outer batters)	✓	✓	✓	Commenced	248	Not yet rehabilitated
SWRE (excluding outer batters)	✓	✓	✓	Commenced	140	Southern section shaped
NWRE outer batters	✓	✓	✓	Commenced	65	Some sections shaped and covered
SWRE outer batters	✓	✓	✓	Commenced	45	Some sections shaped and covered
Ore Stockpiles	✓	✓	✓	Commenced	74	Not yet rehabilitated
Tailings service corridor	✓	✓	✓	Complete	5	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*		
Soil stockpiles	✓	✓	✓	Commenced	91	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
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	2	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

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*		
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 relevant environmental assessments and approvals, the RMP and the MOP.

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.

Approximately 7.8ha of the inner perimeter wall was shaped and covered with 300mm rock mulch in the reporting period (Plate 4).

Plate 1: South Side of Perimeter Waste Rock Emplacement Prior to Stripping for Stage H

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 4 ha was topsoiled on the upper slopes, 2 ha on the mid slopes and 2 ha on the upper six batters 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).

Tube stock was planted at the western end of the NWRE across all 12 batters, and were monitored during the reporting period.

Plate 2: North Side of Northern Waste Rock Emplacement (June 2017)

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, topsoil was applied to the upper five batters at the western end. Above the trial area an area of approximately 7 ha was shaped, and rock mulch and topsoil were applied. Gypsum application was completed and direct seeding is forecast to be conducted in the next reporting period.

Due to rain in 2016, some areas of the SWRE proposed for rehabilitation in the MOP were unable to be completed in the 2016 reporting period. These areas were rehabilitated during the 2017 reporting 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.

Plate 3: North Side of Southern Waste Rock Emplacement (November 2017)

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. Final landforms and final land use areas are presented on Figure 17.

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) on the NWRE and *Avena fatua* (Wild Oats) on the SWRE, with the exception of PWRE01 which had been stripped in preparation for stage H. Due to the increase in protective litter cover and slight to moderate levels of litter decomposition, there has been a decrease in surface crusting, increased soil coherency and there was less evidence of resources being mobilised across the sites.

NWRE03 and NWRE04 had low stability, infiltration and nutrient recycling and overall low ecological function in comparison to the hill reference sites. Site NWRE03, which was re-ripped and planted in 2016 presently had the least ecological function. Both sites had low total ground cover and low cover of perennial plants.

Floristic diversity typically declined across the range of sites due to the prolonged dry conditions which were also compounded by levels of grazing pressure in some sites, especially the reference sites. There was an increase in native plant cover in all the rehabilitation sites on the WREs. Native species were more diverse than exotic species but exotic species provided most of the live plant covers in all sites and were weedier than desired, except NWRE01.

This year the hardy perennial native species *Sclerolaena muricata* (Black Roly Poly), *Convolvulus erubescens* (Australian Bindweed) and *Walwhalleya proluta* (Walwhalleya proluta) were recorded in all five rehabilitation sites. *Atriplex semibaccata* (Creeping Saltbush) and *Eriochloa crebra* (Cup Grass) were also relatively common. The exotic annuals *Lactuca serriola* (Prickly Lettuce), *Avena fatua* (Wild Oats) and *Lolium rigidum* (Wimmera Ryegrass) were recorded in four of the rehabilitation sites. Some, but not all common species were also recorded in the reference sites.

There was also considerable variation in the diversity of growth forms in the rehabilitation areas on the WREs with only NWRE03 having an acceptable composition of species as a result of tree planting program, despite having a low survival rate of only 21%. In the remaining sites there was typically low density and diversity of trees and shrubs. In some sites however there were some volunteer shrubs becoming established.

In the WREs Electrical Conductivity levels appear to be declining and this year the soils were classed as slightly saline. The soils however were moderately to strongly alkaline with most except NWRE01 also being sodic. The soils were low in organic matter and phosphorous and most had very high Cation Exchanged Capacity. In previous soil analyses, sulfur concentrations were particularly high in some of the sites on the WREs. Follow up soil analyses has indicated that sulfur levels had significantly declined in 2015 but these continue to be in excessively high concentrations compared to the recommended guidelines of 8.0 mg/kg. Lowest S concentrations were 18.9 mg/kg and were recorded in SWRE01. On the NWRE lowest S concentrations were 59.1 mg/kg at NWRE03 while the highest was 295 mg/kg at NWRE01.

In the rehabilitation sites on the NWRE's and SWRE there were significantly high levels of calcium, magnesium and arsenic, and potassium levels were elevated. Magnesium and potassium levels were also elevated in the reference sites suggesting they may occur naturally at elevated levels, however they did not tend to occur in such high concentrations in the natural environment (DnA Environmental, 2017a).

8.2.2 Rehabilitation Trial Monitoring Results

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.

The monitoring of these trials have been consistent with that used for the annual ecological monitoring 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 in the Lake Cowal area. A selection of primary performance indicators provide the benchmark for rehabilitation success and therefore comprise the completion criteria required for mine closure and are consistent with the most recent revision of the ESG3 MOP guidelines. In 2017 only tubestock counts and their height classes were recorded in each of the replicated trial treatments.

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 also occurred, therefore the results should be treated with consideration.

The 2017 data has indicated that the density of trees and mature shrubs > 5cm dbh (and >2.0m in height) is greater on the older 2012/2013 trial area with one treatment (300Straw) already having comparable tree populations to the reference sites.

Plate 4: NWRE – Pond D1 North Trial Tubestock (April 2017)

In the trial sites, average shrub and juvenile tree (<5cm dbh) densities ranged from a low of 442 (300Straw) to a high of 667 stems per hectare (14-300Straw), and all trial sites presently had stem densities comparable to the local hill woodlands.

The data has shown that the heavy application of straw and NPH mulches is likely to increase growth rates of the shrubs and juvenile trees on average but was not imperative for growth. The data to date has demonstrated that mulching can improve the growth rates of planted native tubestock, however the previous results have also shown that floristic diversity and perennial ground cover targets may be compromised, at least in the early development stages where mulch was applied thickly.

The data however has not clearly demonstrated that the depth of topsoil affected the growth rate and therefore heights of the shrubs and juvenile trees. In the 2012/2013 trial area there was no difference in densities in the >2.0m height class, however in the 2014 trials area there were a greater of number of tall individuals when they grew in 300mm of topsoil. There were however a marginally higher number of individuals on average that were taller when they were growing in the 300mm topsoil application when only topsoil treatment were interrogated across the whole trial area. It is probable that topsoil is not applied with even distribution and depth of application across rehabilitation areas, and these are often confounded by other factors in particular topsoil origin and chemistry.

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 conclusively if 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 develop a mature tree canopy and tree and shrub densities increase as a result of natural regeneration. Previous data and observations made in 2017 indicate that many native perennial grasses and other ground covers are becoming increasingly more abundant, especially in treatments where native pasture hay was applied and when no mulch was applied. Mulching using straw or native pasture hay has also improved growth rates of planted tubestock in this trial (DnA Environmental, 2017a).

Investigations into the depth of the roots of the planted tubestock in 2016 have indicated that the roots (and subsequent tree growth) are 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. Despite the prolonged dry conditions experienced throughout most of 2017, most of the trees and shrubs on the trial area appeared very healthy with many bearing fruit (DnA Environmental, 2017a).

These trials will continue 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 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 CGO.

9.1 COMMUNITY COMPLAINTS

The Development Consent and EPL 11912 require implementation of a complaints mechanism. A community line for enquiries, feedback or complaints 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 Evolution Cowal Community Line. Details of the Community Line 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 Senior Social Responsibility Advisor receives a copy of the notice emailed to their assigned mobile phone. Upon receiving an enquiry, the Senior Social Responsibility Advisor 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 CGO.

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

Summary of Community Complaints 2017	
Record No 1	
Details	Community Member
Complaint/Concern	Company vehicle
Date	21/03/2017
Outcome	1. Truck driver phoned community line to advise his vehicle was sprayed with rocks from an overtaking mine vehicle. 2. Truck driver didn't leave name. 3. Sustainability Manager followed up with CGO driver who advised that the truck had slowed down, and he thought, the truck had pulled across for him to pass.
Date of Response	Initial response – 21/03/2017 Complaint closed – 21/03/2017
Record No 2	
Details	Resident of Lake Cowal
Complaint/Concern	Blasting
Date	23/05/2017 – 12:30pm
Outcome	1. A landholder on the Eastern side of Lake Cowal called the Senior Environmental Advisor to advise that the blast had shaken their house. No damage was reported. 2. Senior Environmental Advisor requested a review of the blast data from external blasting consultants and consulted with Mining Superintendent. 3. Preliminary blast results were received from external consultants indicated that the blast was within compliance limits (95.9 dB(L)). 4. Senior Environmental Advisor emailed the blast investigation to the landholder and called to discuss the results. The investigation indicated that the blast was within compliance limits.
Date of Response	Initial response – 23/05/2017 Complaint closed – 25/05/2017
Record No 3	
Details	Resident of West Wyalong
Complaint/Concern	Vehicles damaged
Date	23/06/2017 – 3.00pm
Outcome	1. A resident in West Wyalong called into the ECCC to advise that the tenants of the Evolution-owned house next door had cleaned their gutters with a blower and hose washing a thick blanket of debris on top of three vehicles in their yard. Vehicles required cleaning and buffing to remove minor scratches. 2. Manager (People & Culture) investigated with real estate and found that local handyman cleaned gutters.
Date of Response	Initial response – 23/06/2017 Complaint closed – 25/06/2017

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

Record No 4	
Details	Near neighbour
Complaint/Concern	Blasting
Date	14/08/2017 3.30pm
Outcome	1. A near neighbour called the Senior Environmental Advisor to advise that the blast conducted on the 14/08 had shaken their house. 2. Investigation was commenced .The investigation found that all compliance monitoring locations were within compliance limits. 3. The Senior Social Responsibility Advisor called to the near neighbour to discuss investigation results; and forwarded a copy of the blast monitoring report and commentary, by email, following the call. The neighbour advised they were happy with the results of the investigation.
Date of Response	Initial response – 14/08/2017 Complaint closed – 16/08/2017
Record No 5	
Details	Community member contacted site about an Evolution Mining vehicle not driving to the conditions on a public road.
Complaint/Concern	Not driving to road conditions on a public road.
Date	23/10/2017
Outcome	1. A near neighbour contacted with Senior Social Responsibility Advisor to advise that an Evolution employee was observed not driving to road conditions on 23 October. 2. Sustainability Manager commenced an investigation into the incident. 3. The investigation found that the Evolution employee was obeying all road rules; however, they could have been more mindful of their actions driving on a gravel road. 4. The results of the investigation were discussed with the Evolution employee. 5. Evolution Employee and Manager reviewed critical controls associated with driving a company-owned vehicle on public roads. 6. Senior Social Responsibility Advisor called to discuss investigation results with the resident. The investigation indicated that the Evolution employee was obeying road rules but could be more mindful of their actions driving on a gravel road. The neighbour advised they were happy with the results of the investigation.
Date of Response	Initial response – 23 October 2017 Complaint closed – 25 October 2017
Record No 6	
Details	West Wyalong Business Owner
Complaint/Concern	Car Parking
Date	6/12/17 7.12am
Outcome	1. A West Wyalong business owner called to advise that an Evolution contractors had parked their car out the front of their business. 2. An investigation was commenced. The investigation found that the contractors were advised about parking within West Wyalong. 3. The Senior Social Responsibility Advisor visited the West Wyalong Business Owner to discuss investigation results; and found that parking signs near the business could prevent this type of incident from occurring in the future. The Senior Social Responsibility Advisor advised they would investigate the purchase of signage. The business owner advised they were happy with the results of the investigation.
Date of Response	Initial response – 06/12/2017 Complaint closed – 14/12/2017

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 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 Cowal Update was released in January 2017 during the reporting period.

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 next Community and Family days are scheduled for October 2018.

In addition, CGO 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 (held quarterly)
- Local landholders, 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 15 and 19 May 2017 by Trevor Brown Principal Environmental Management Auditor and Robert Drury of Trevor Brown & Associates, for Evolution Mining to assess the status of the CGO with the Development Consent conditions. The audit reviewed the status of compliance of the operations from 1 May 2016 to 30 April 2017

The audit was undertaken generally in accordance with the Australian/New Zealand Standards AS/NZS ISO 19011:2017 - Guidelines for Auditing Management Systems. 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 the Development Consent and other statutory environmental approvals.

Recommendations and observations from the IEA are discussed in Table 28. The next Independent Environmental Audit is scheduled for April 2018.

Table 28: Recommendations and Observations from the 2017 Independent Environmental Audit

Recommendation / Observations	Action status
All future revisions of the environmental management plans, strategies and monitoring programs should amend reference to Barrick where relevant and ensure the Development Consent condition numbers in the documents are consistent with Consolidated Development Consent 14/98 MOD 13.	Evolution is in the process of updating all management plans, strategies and monitoring programs to amend reference to Barrick and align with the Development Consent. All cover pages of management plans have been updated, as have the majority of plans as part of MOD 13. This is an ongoing process by Evolution.
It is recommended that consideration should be given to further control of the overabundant macropod numbers on the Fellman's Hill Revegetation Enhancement area.	Evolution held a cull of approximately 200 macropods on the 18-19th of October 2017. Subsequent controlled culls will be planned as deemed necessary.
A Variation to EPL 11912 condition L4.1 Table 1 be requested to ensure consistency with the Development Consent 14/98 MOD 13 condition 6.4(c) Noise impact assessment criteria limits.	The EPL 11912 variation to condition L4.1 Table 1 was approved in May 2017 to be consistent with the Development Consent 14/98 MOD 13 condition 6.4(c).

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
ECCC	Evolution Cowal Consultation Centre
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 Plan
RMP	Rehabilitation and Offset Management Plan
RVEP	Remnant 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

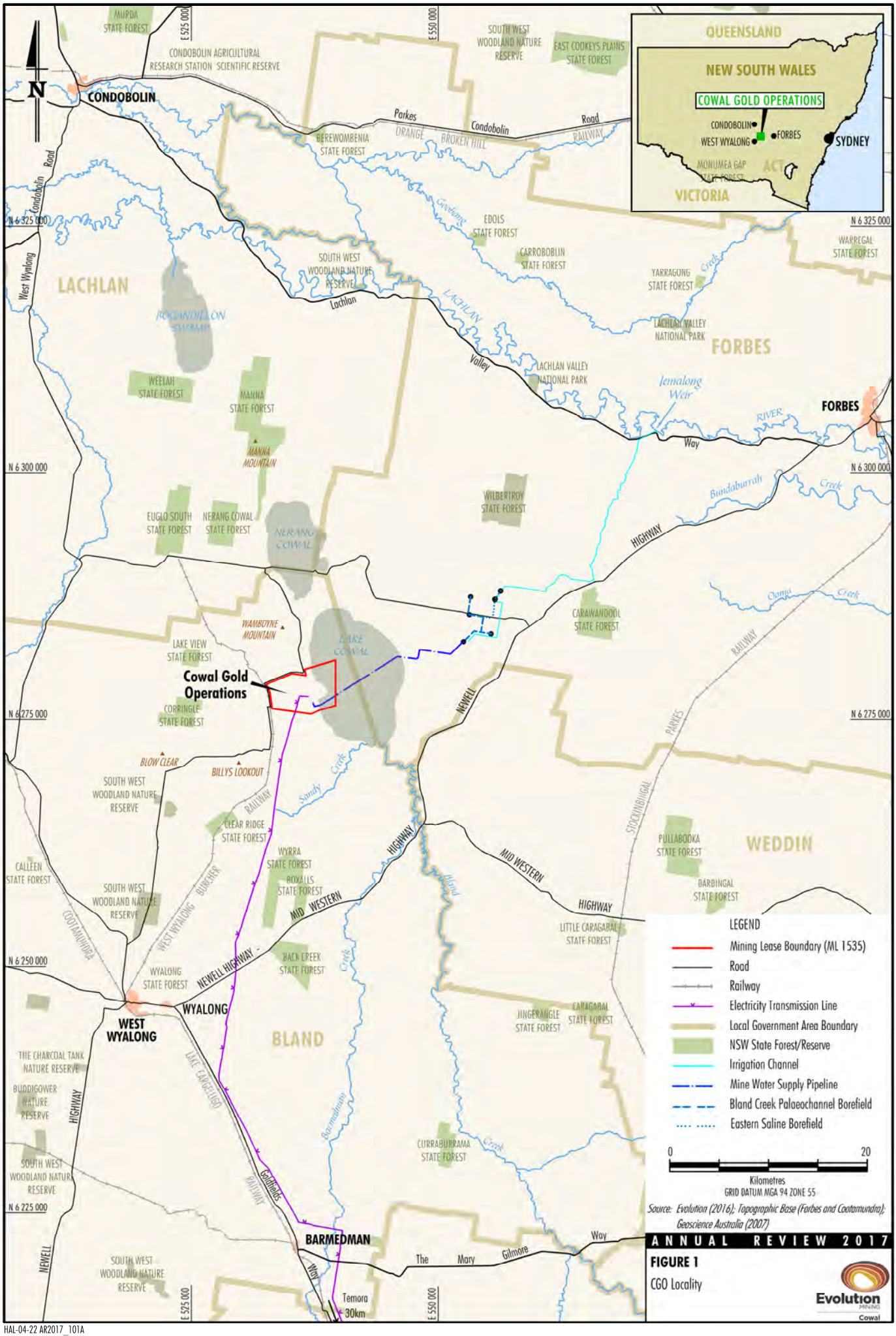

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FIGURE 1

CGO Locality

Evolution MINING Cowal

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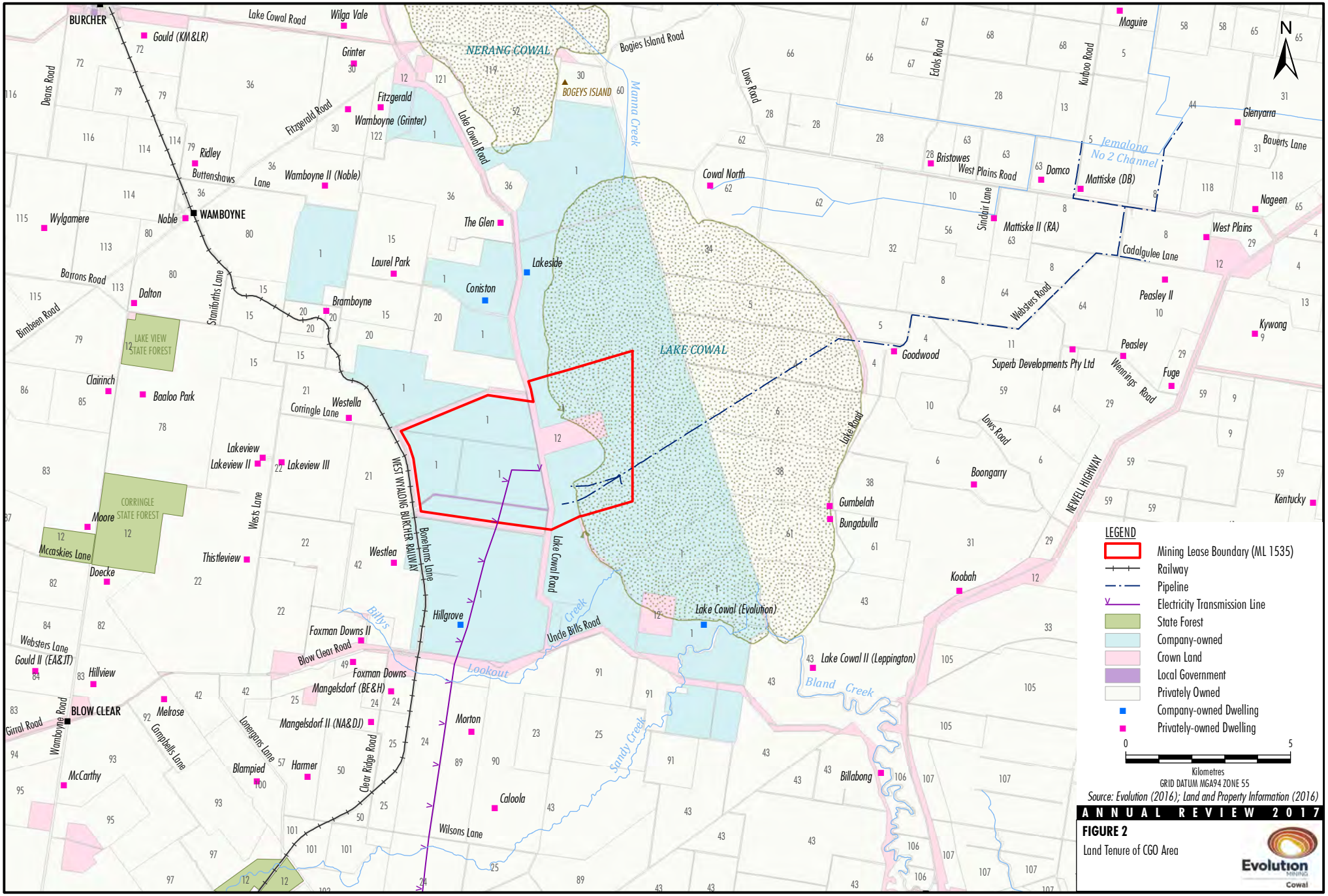

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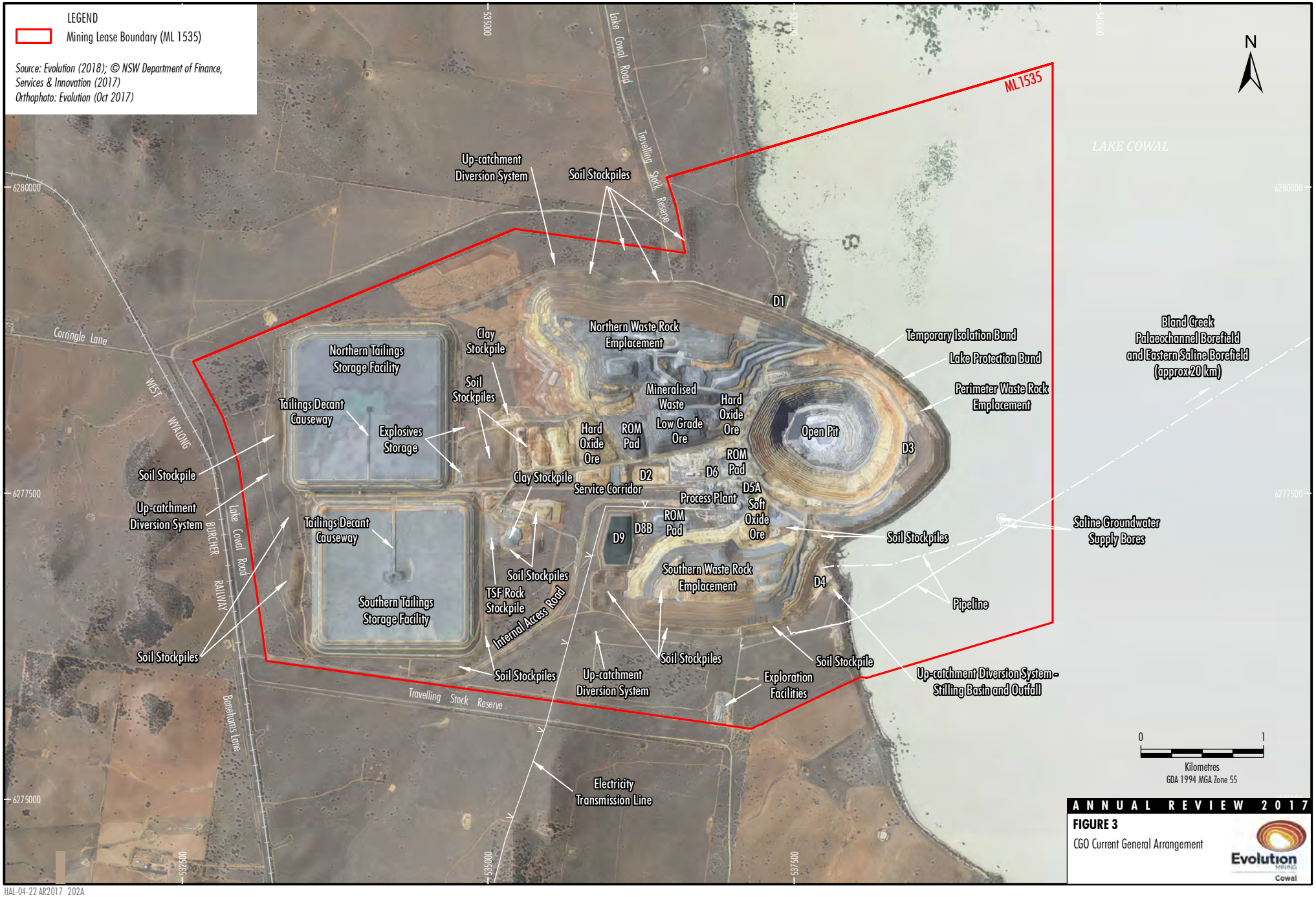
FIGURE 2

Land Tenure of CGO Area

Evolution MINING Cowal



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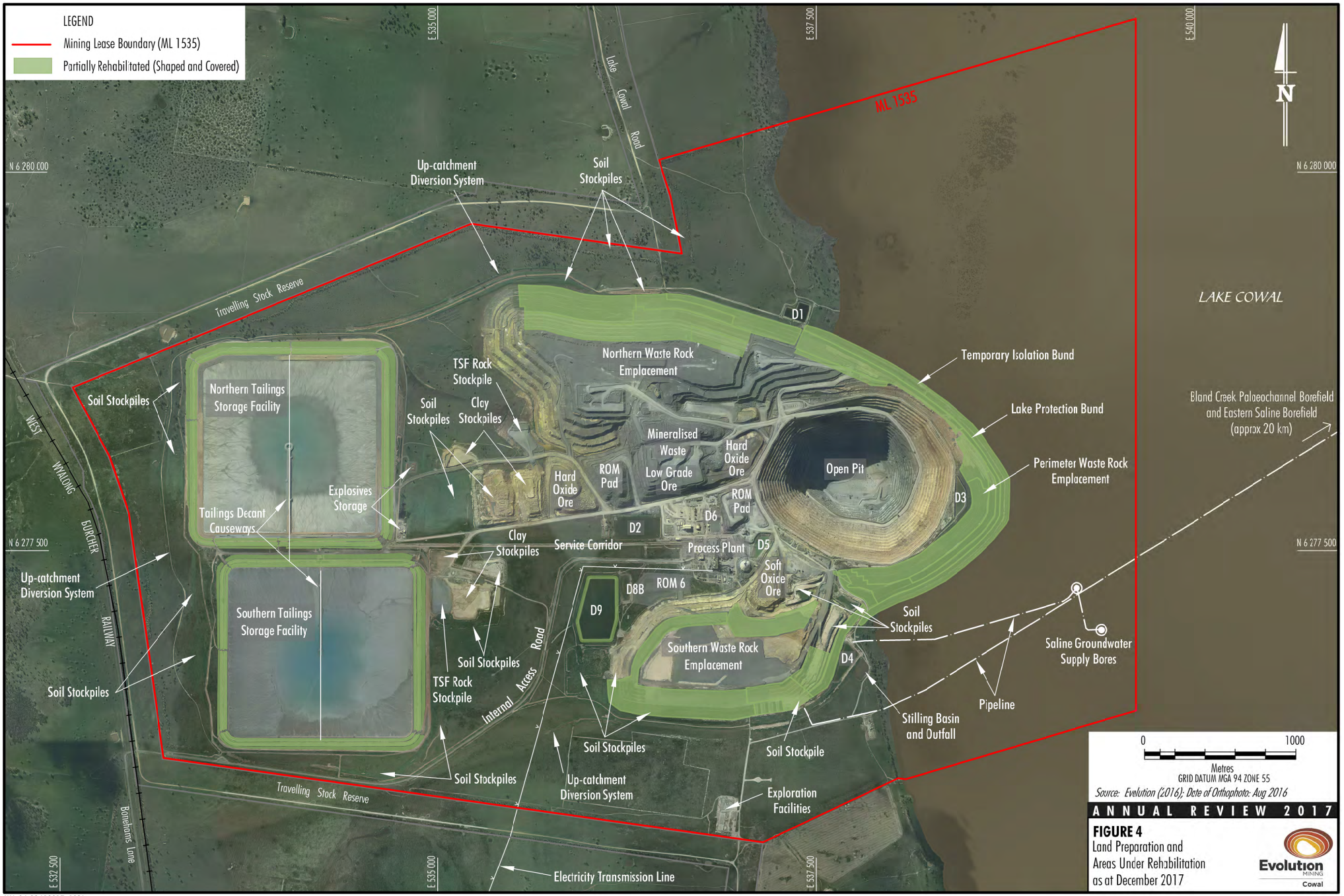

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FIGURE 4
Land Preparation and Areas Under Rehabilitation as at December 2017

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HAL-04-22 AR2017_102A

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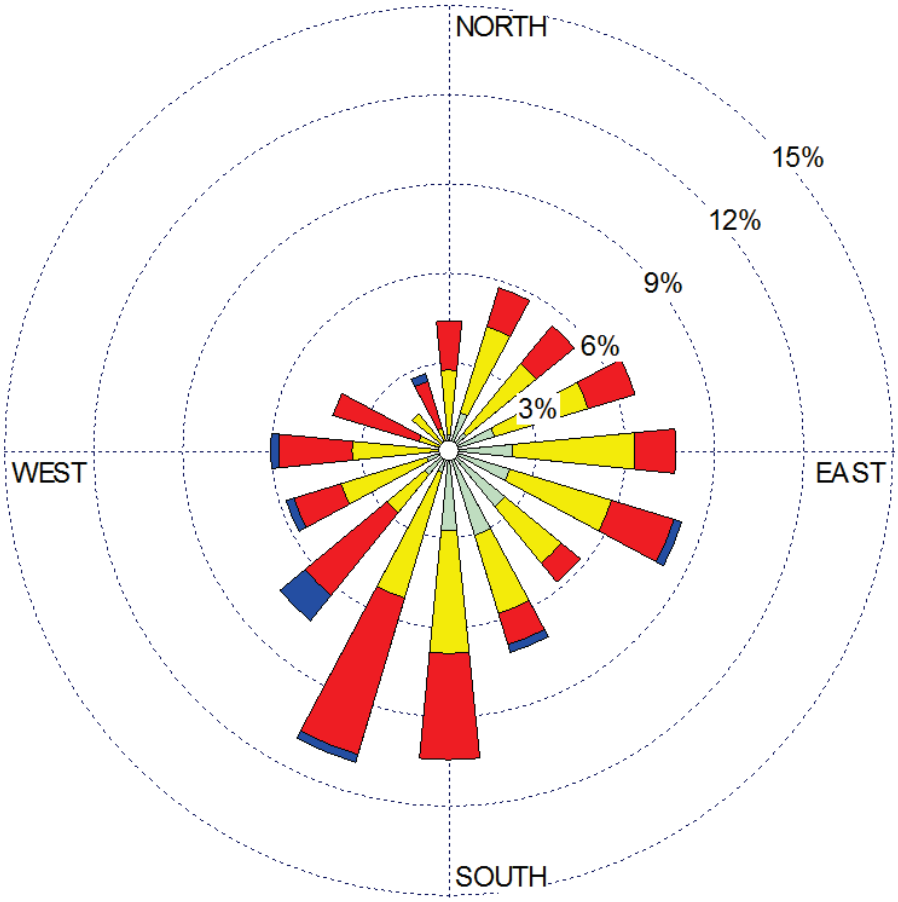
FIGURE 5
Location of Offset Areas and Remnant Vegetation Enhancement Programme Areas

Evolution MINING Cowal

HAL-04-22 AR2017_203A



Wind speed (km/hr)

2–8	21–32
8–13	32–40
13–21	>40

Source: University of Sydney (2018)

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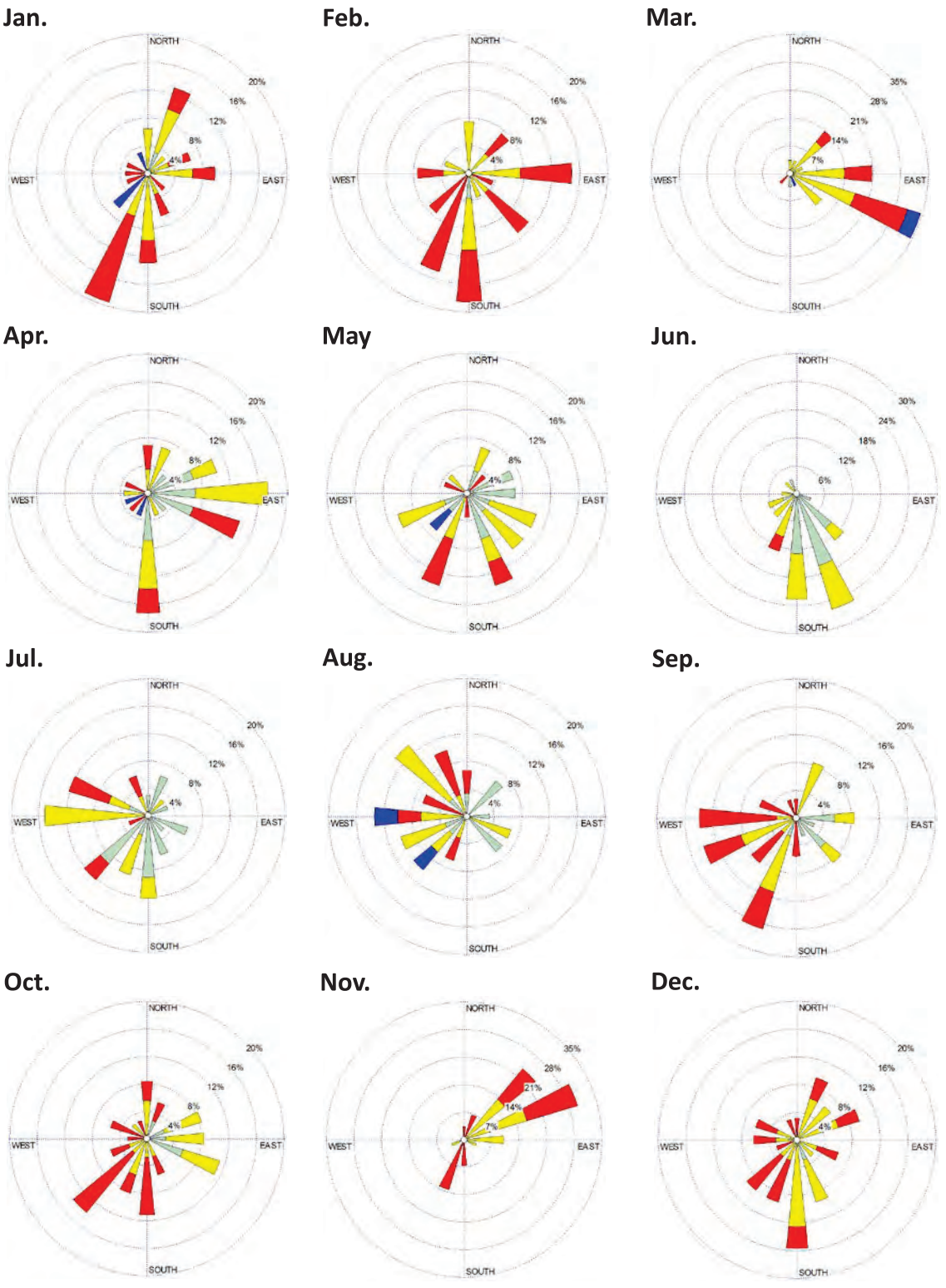
FIGURE 6a

Annual Wind Rose for 2017

Evolution Mining Cowal



Source: University of Sydney (2018)

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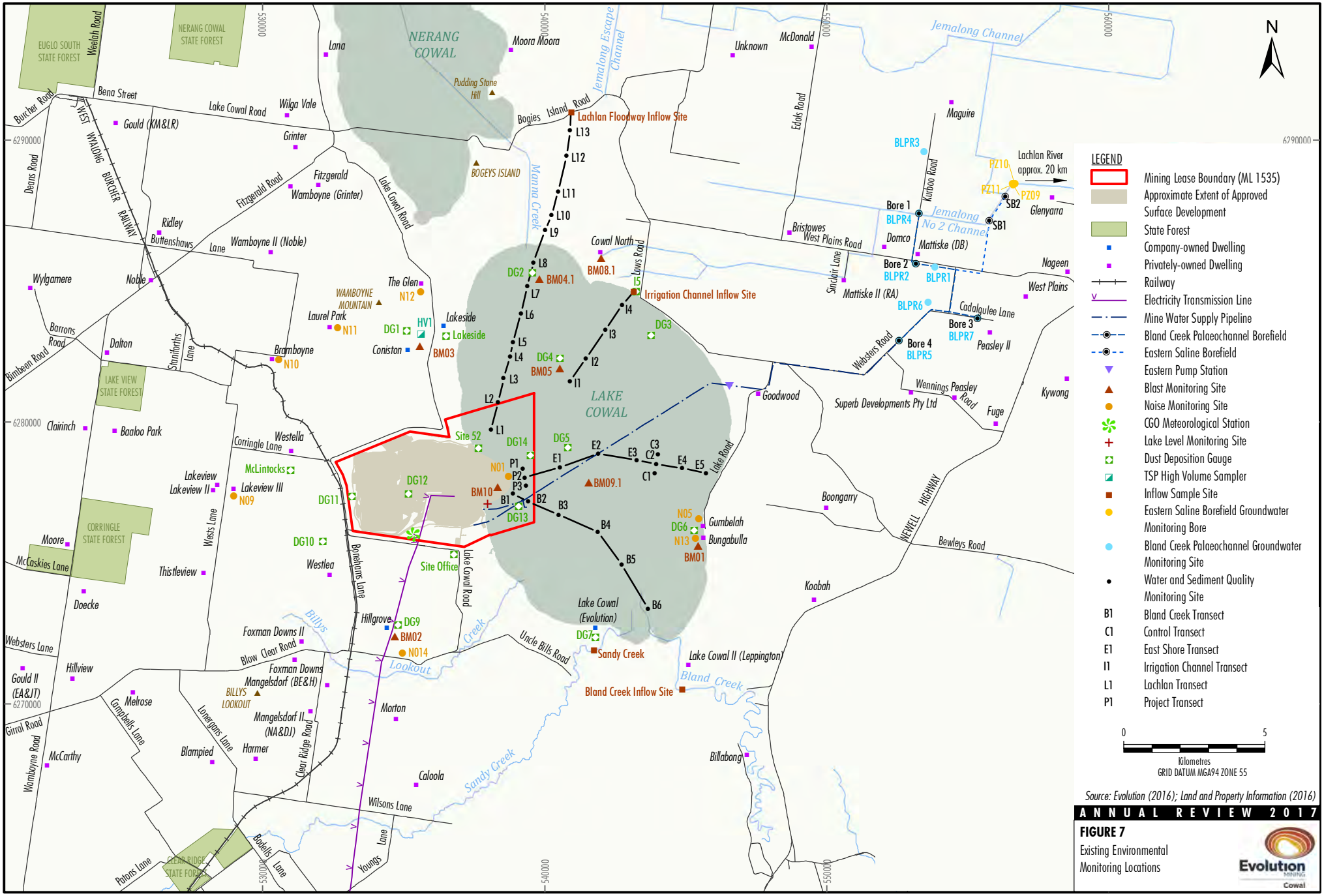
FIGURE 6b

Monthly Wind Roses for January - December 2017

Evolution Mining Cowal

HAL-04-22_AR2017_004A



HAL-04-22 AR2017_204A

HAL-04-22 AR2017_103A

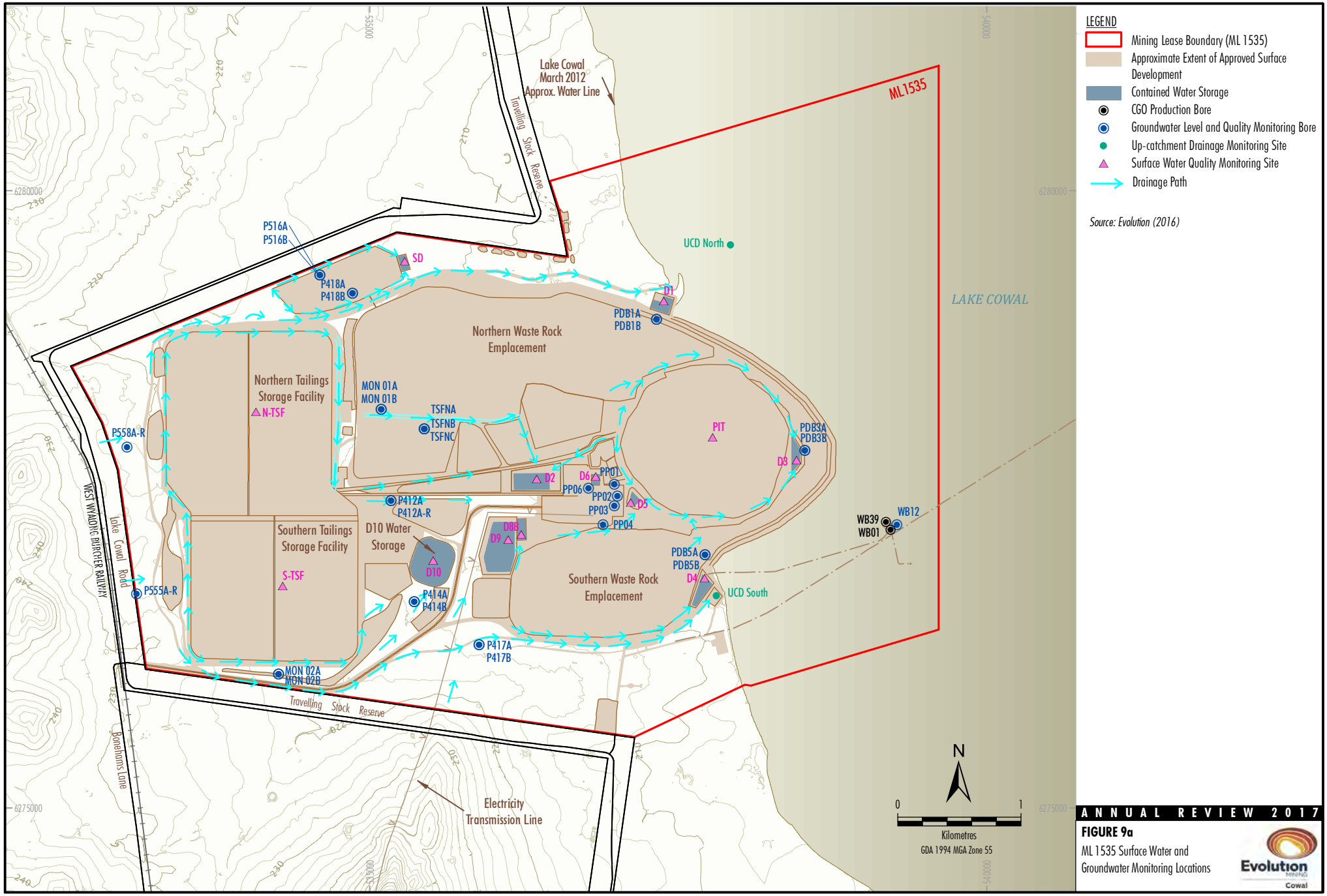


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FIGURE 9a

ML 1535 Surface Water and Groundwater Monitoring Locations

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HAL-04-22 AR2017_205A

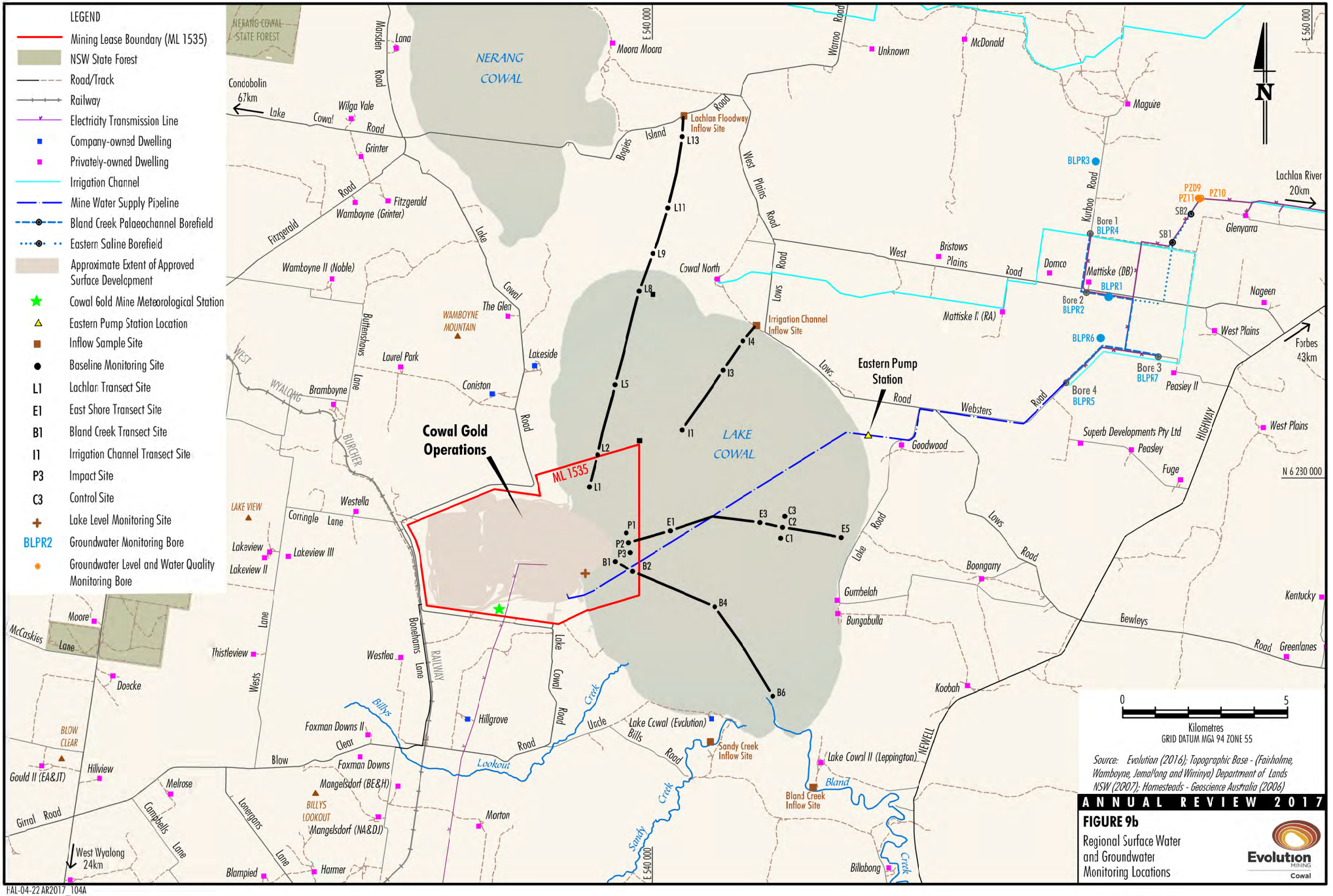
LEGEND
Mining Lease Boundary (ML 1535)
NSW State Forest
Road/Track
Railway
Electricity Transmission Line
Company-owned Dwelling
Privately-owned Dwelling
Irrigation Channel
Mine Water Supply Pipeline
Bland Creek Palaeochannel Borefield
Eastern Saline Borefield
Approximate Extent of Approved Surface Development
Cowal Gold Mine Meteorological Station
Eastern Pump Station Location
Inflow Sample Site
Baseline Monitoring Site
L1 Lachlan Transect Site
E1 East Shore Transect Site
B1 Bland Creek Transect Site
I1 Irrigation Channel Transect Site
P3 Impact Site
C3 Control Site
Lake Level Monitoring Site
BLPR2 Groundwater Monitoring Bore
Groundwater Level and Water Quality Monitoring Bore
NERANG COWAL STATE FOREST
NERANG COWAL
LAKE COWAL
Cowal Gold Operations
ML 1535
Eastern Pump Station
Lachlan Floodway Inflow Site
Irrigation Channel Inflow Site
Sandy Creek Inflow Site
Bland Creek Inflow Site
Cowal North
Mattiske (DB)
Mattiske II (RA)
Wamboyne (Grinter)
Wamboyne II (Noble)
WAMBOYNE MOUNTAIN
Coniston
Laurel Park
Lakeside
The Glen
Bramboyne
Westella
Thistleview
Hillgrove
Foxman Downs
Foxman Downs II
Mangelsdorf (BE&H)
Mangelsdorf (NA&DJ)
BILLYS LOOKOUT
Morton
Harmer
Blampied
Lake Cowal (Evolution)
Lake Cowal II (Leppington)
Billabong
Gumbelah
Bungabulla
Boongarry
Goodwood
Peasley
Peasley II
Superb Developments Pty Ltd
Fuge
Glenyarra
Nageen
West Plains
Domco
Bristows
Maguire
McDonald
Unknown
Moora Moora
Lana
Grinter
Wilga Vale
Condobolin 67km
Lachlan River 20km
Forbes 43km
Bore 1 BLPR4
Bore 2 BLPR2
Bore 3 BLPR7
Bore 4 BLPR5
BLPR1
BLPR3
BLPR6
PZ09
PZ10
PZ11
SB1
SB2
L1
L2
L5
L8
L9
L11
L13
I1
I3
I4
P1
P2
P3
B1
B2
B4
B6
E1
E3
E5
C1
C2
C3
E 540 000
E 560 000
N 6 230 000
N
0
5
Kilometres
GRID DATUM MGA 94 ZONE 55
Source: Evolution (2016); Topographic Base - (Fairholme, Wamboyne, Jemalong and Wirrinya) Department of Lands NSW (2007); Homesteads - Geoscience Australia (2006)
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FIGURE 9b
Regional Surface Water and Groundwater Monitoring Locations
Evolution MINING
Cowal
FAL-04-22 AR2017_104A

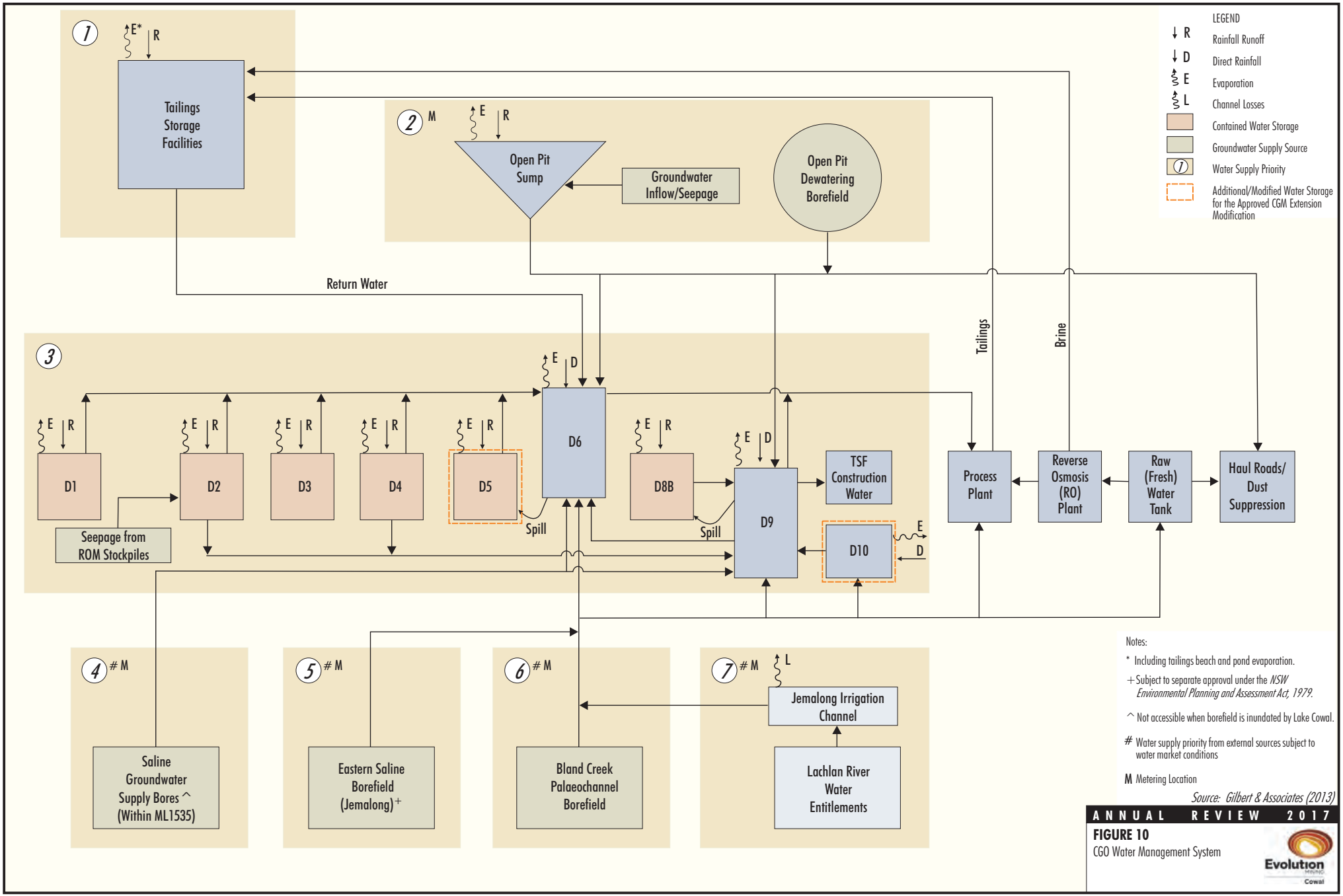

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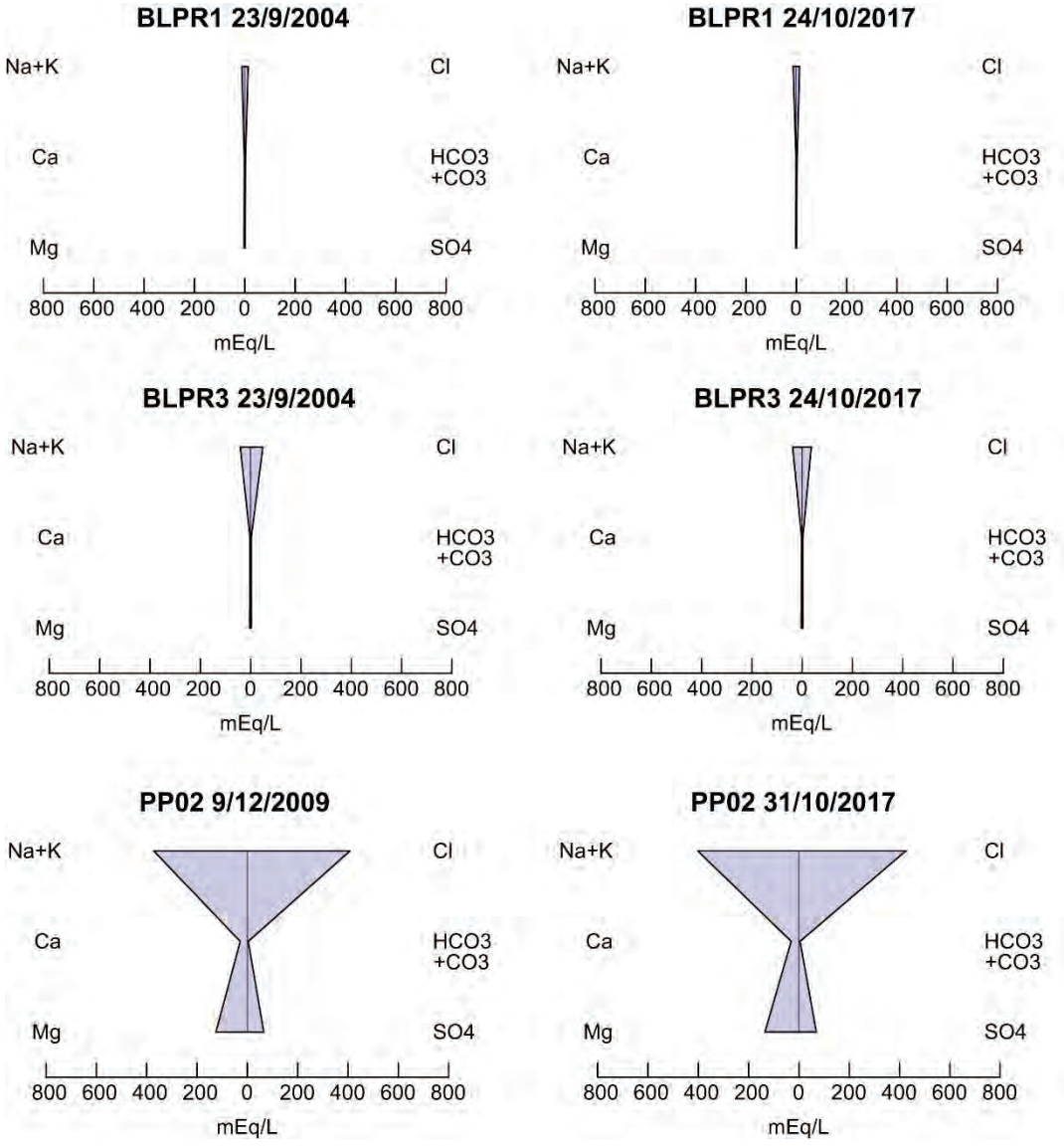
FIGURE 10
CGO Water Management System

HAL-04-22_AR2017_005A



Source: Coffey Geotechnics Pty Ltd (2018)

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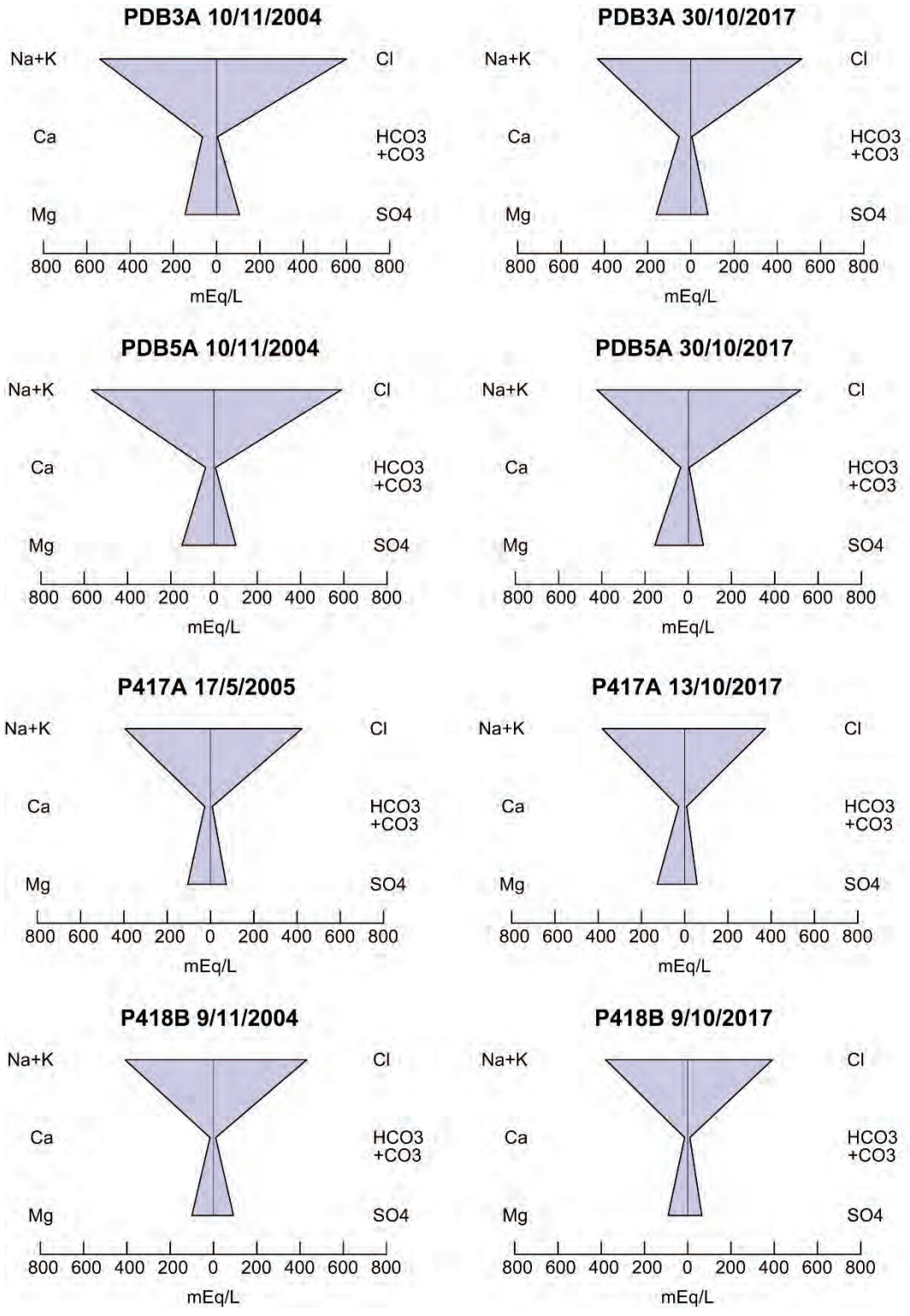
FIGURE 11a

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



Source: Coffey Geotechnics Pty Ltd (2018)

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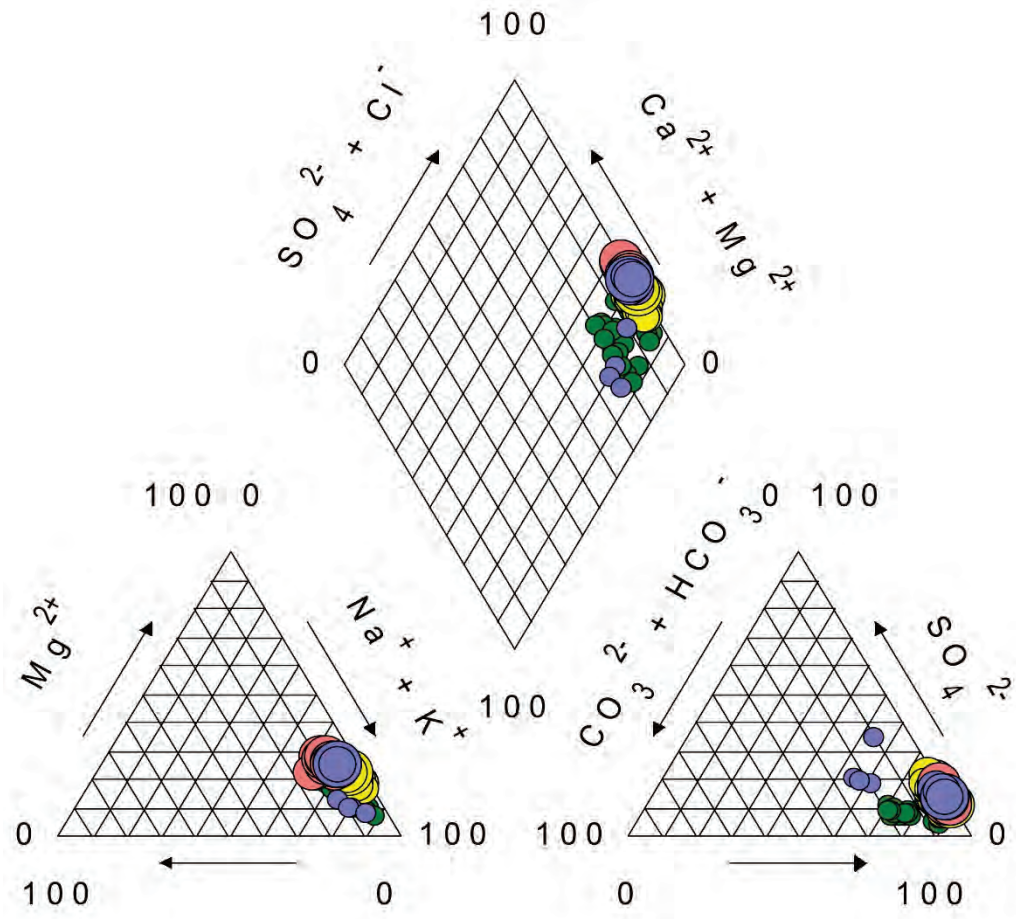
FIGURE 11b

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

Evolution Mining Cowal



EXPLANATION

- Bland Creek Palaeochannel Borefield
- Tailings Storage Areas
- Pit Area
- Processing Plant Area

Symbol size is proportional to TDS concentration (mg/L):

- 756
- 61600

Source: Coffey Geotechnics Pty Ltd (2018)

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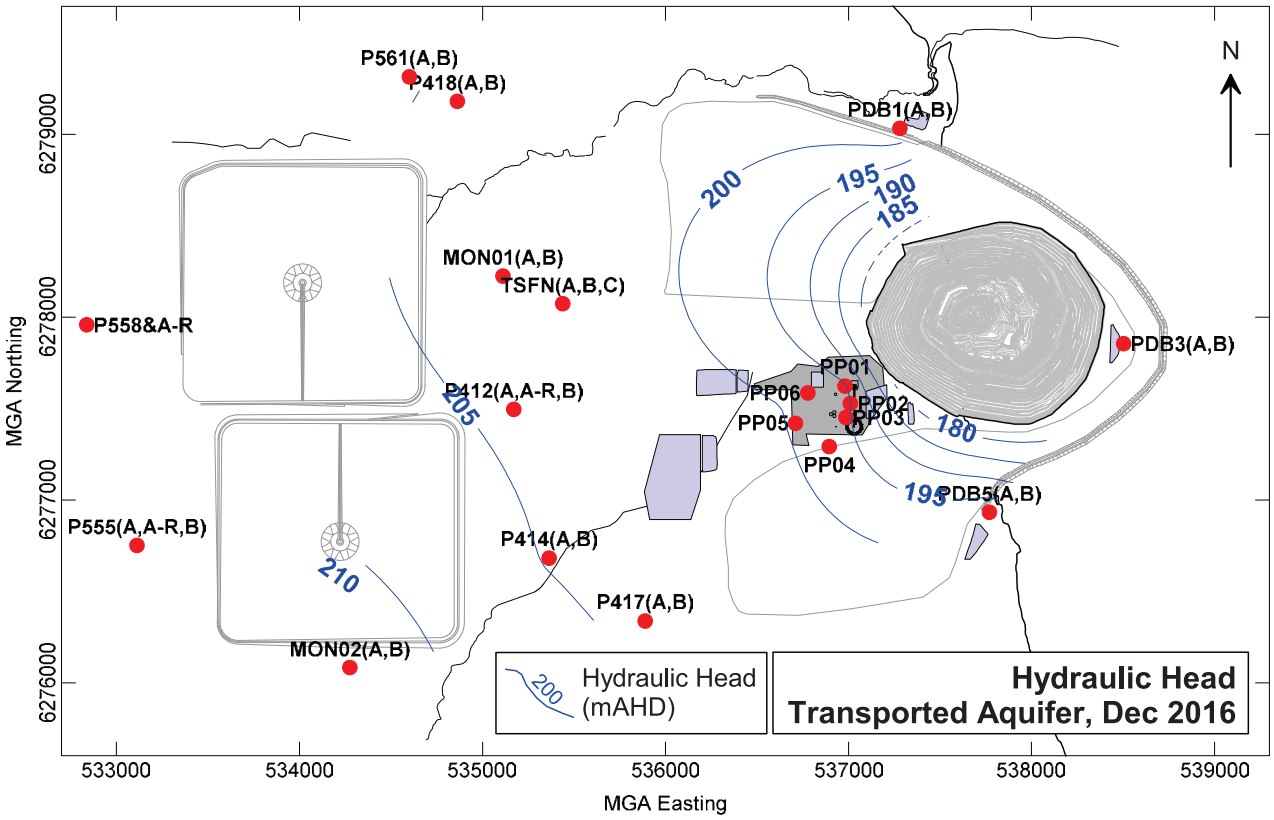
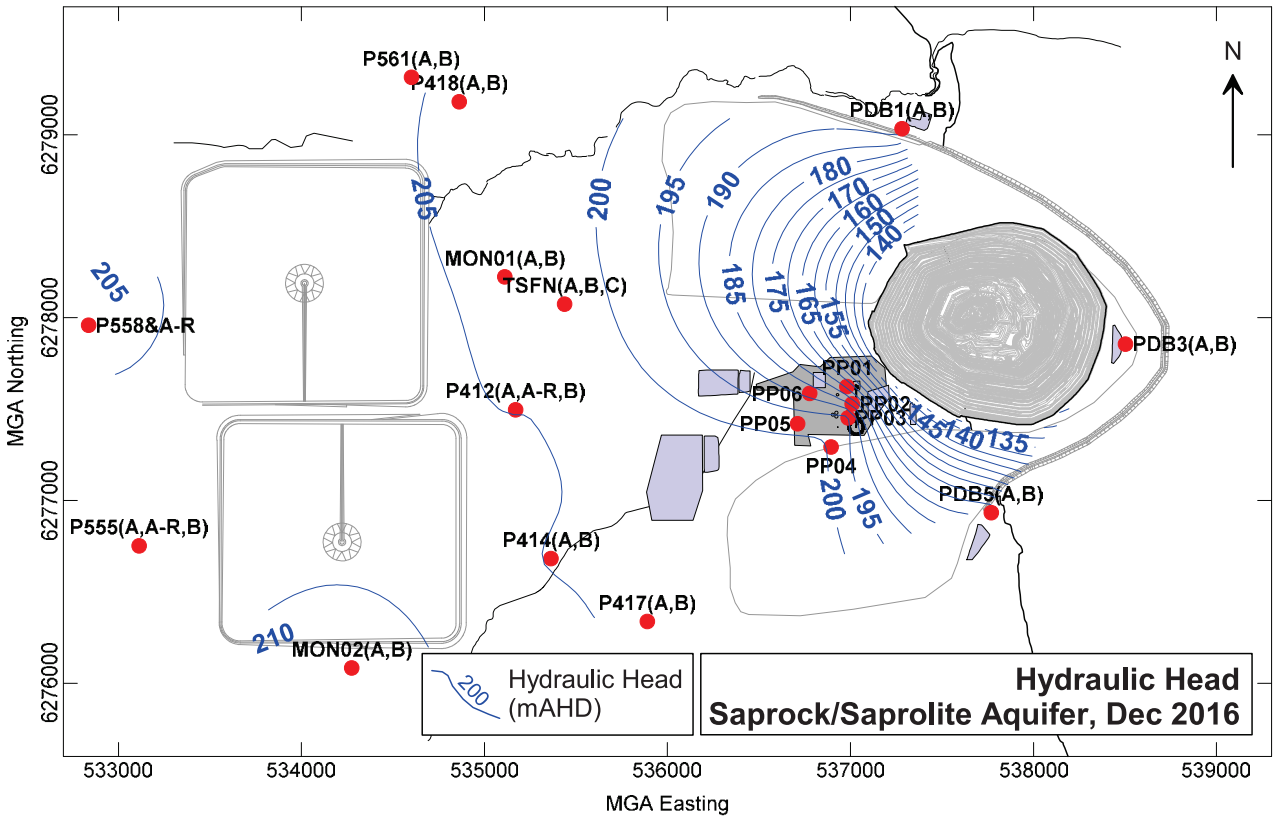
FIGURE 12

Piper Plot of Ground Chemistry

Evolution Mining Cowal





Source: Coffey Geotechnics Pty Ltd (2018)

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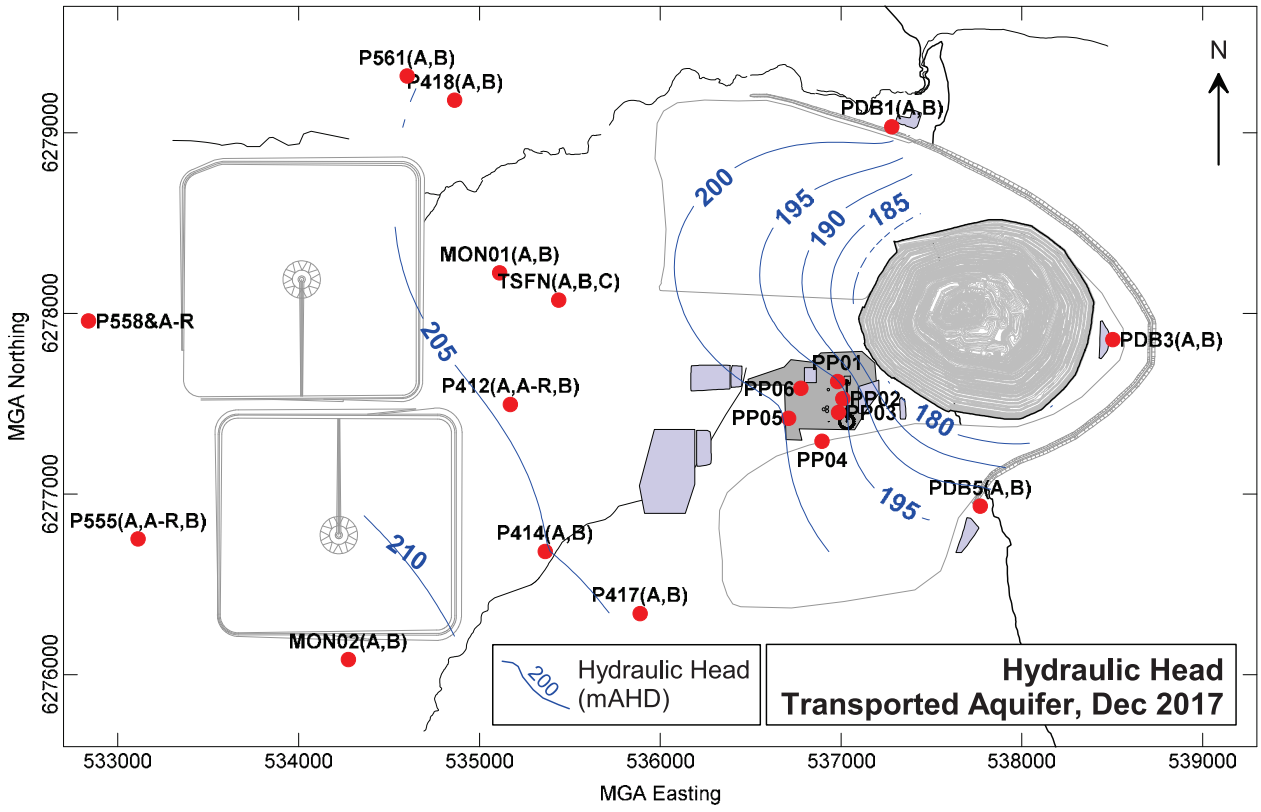
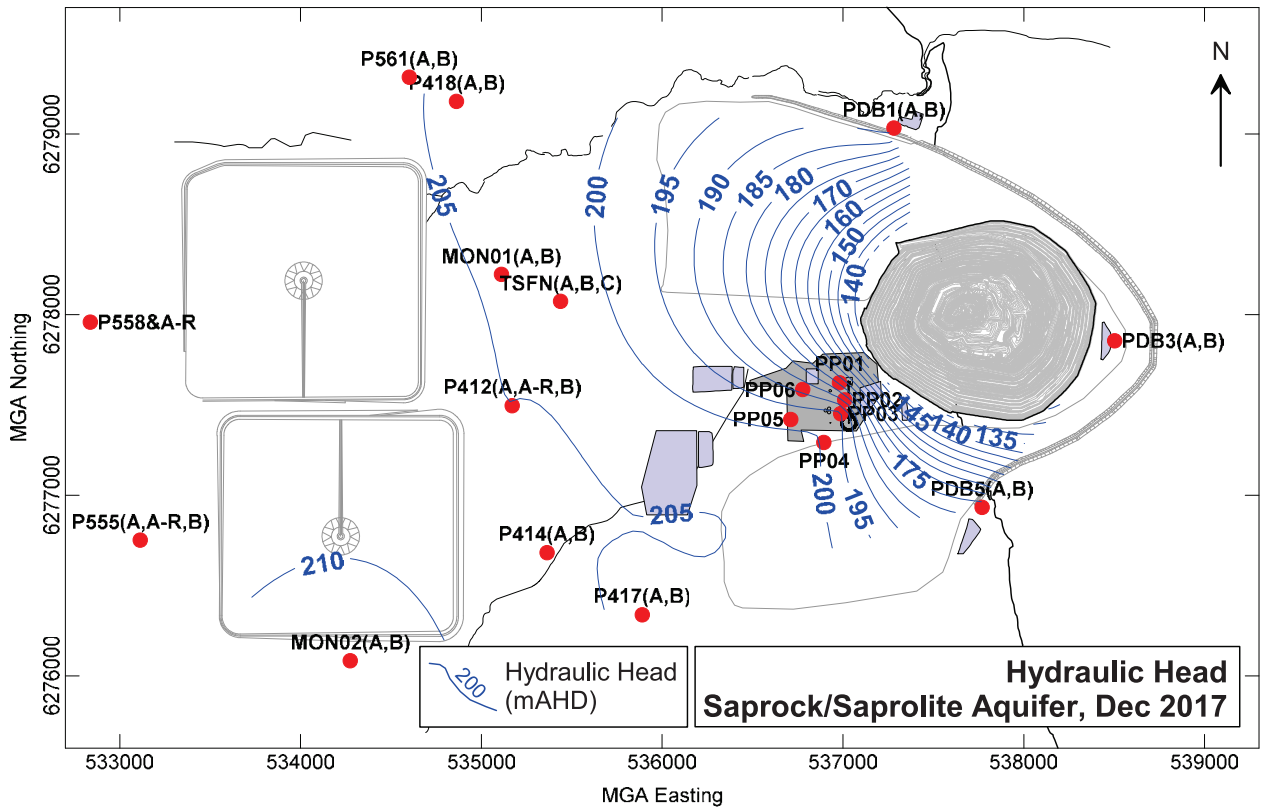
FIGURE 13a

Deep Groundwater Contours

Evolution Mining Cowal





Source: Coffey Geotechnics Pty Ltd (2018)

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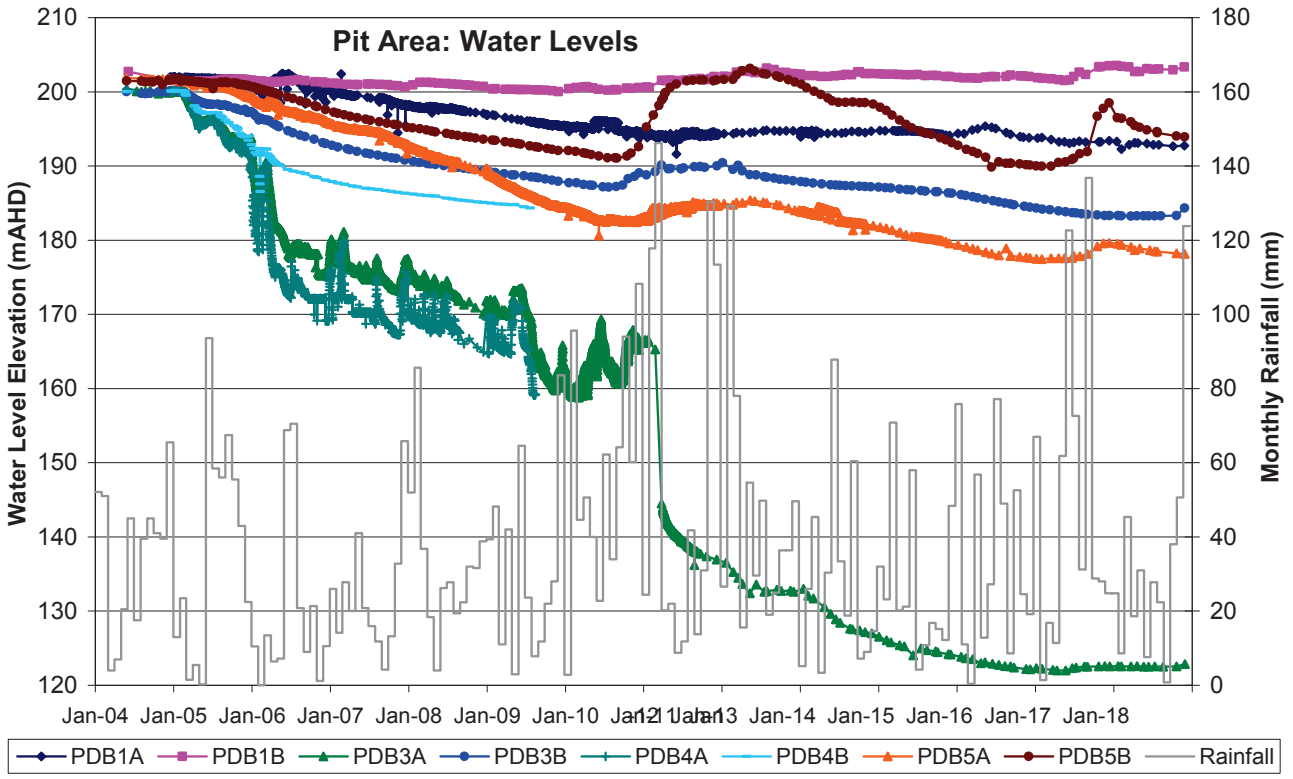
FIGURE 13b

Shallow Groundwater Contours

Evolution Mining Cowal



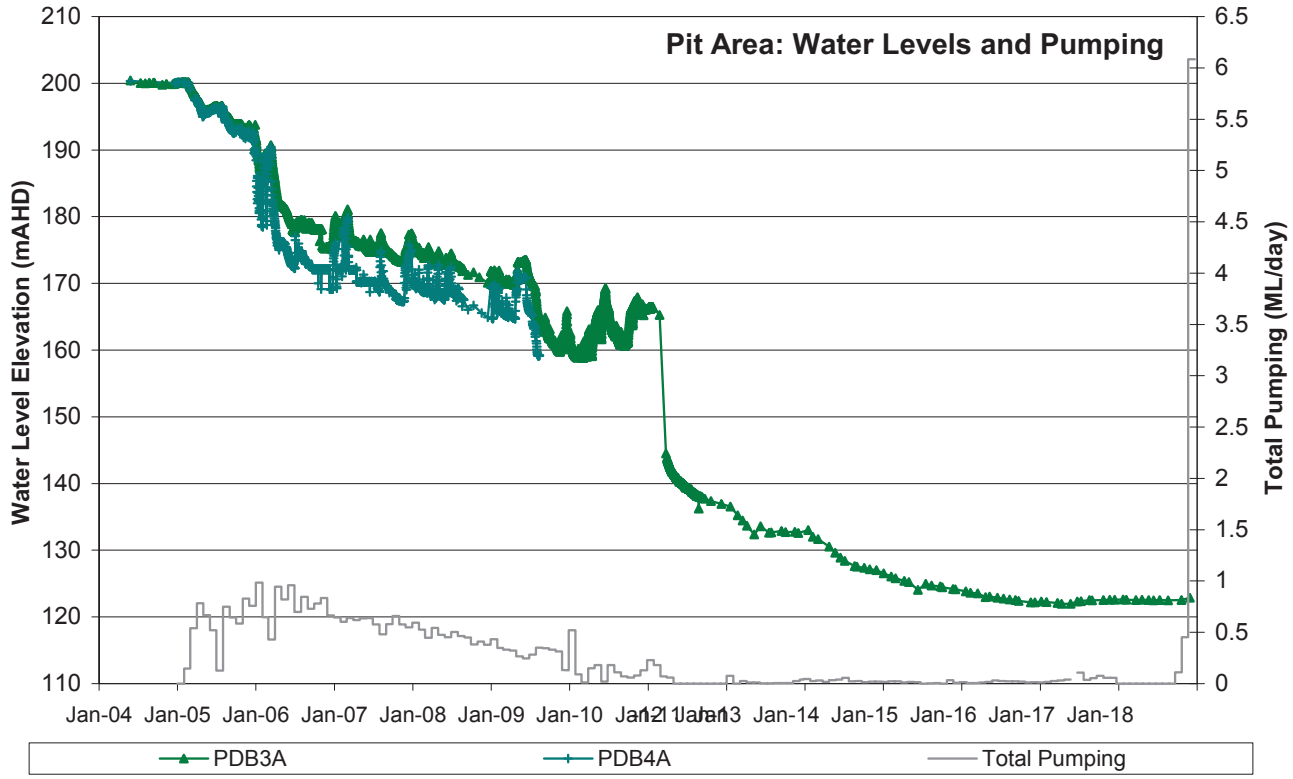


FIGURE 14

Standing Water Levels Measured During the Reporting Period

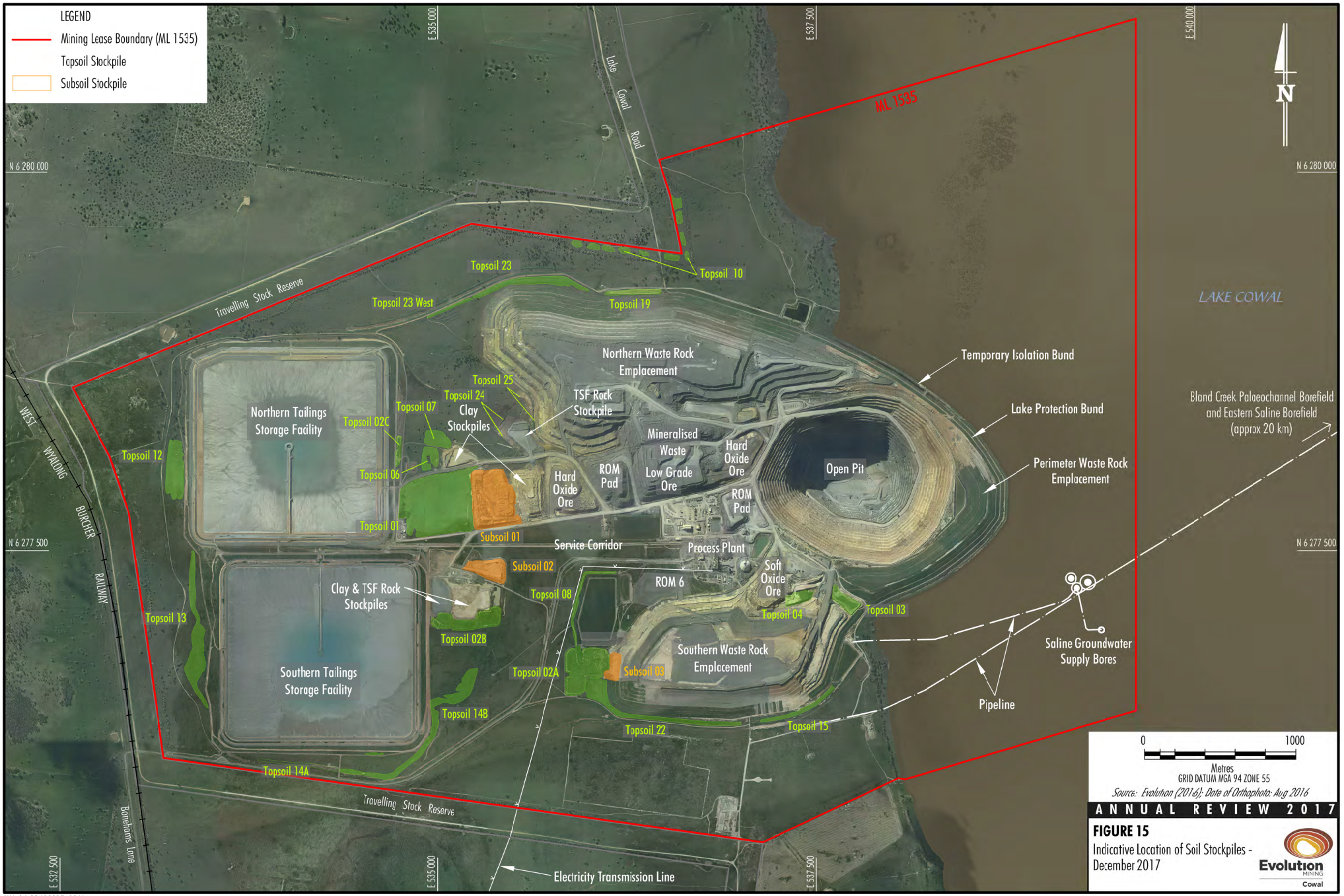


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FIGURE 15

Indicative Location of Soil Stockpiles - December 2017

Evolution MINING Cowal

HAL-04-22 AR2017_106A

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FIGURE 16

Location of Rehabilitation, Offset and RVEP Monitoring Sites

Evolution MINING Cowal

HAL-04-22 AR2017_206A

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FIGURE 17

Conceptual Final Landform and Proposed Final Land Use Areas

Evolution Mining Cowal

HAL-04-22 AR2017_207A