FOURTH ANNUAL REPORT OF THE INDEPENDENT MONITORING PANEL FOR THE COWAL GOLD PROJECT – OCTOBER 2008

INTRODUCTION

The Independent Monitoring Panel (IMP) was established in accordance with condition 8.8(b) of the Development Consent for the Cowal Gold Project. The members of the IMP are:

- Emeritus Professor Clive Bell, University of Queensland; former Executive Director, Australian Centre for Minerals Extension and Research (ACMER)
- Dr Craig Miller, Stream Leader – Biodiversity Conservation, Management and Implementation, CSIRO Sustainable Ecosystems
- a NSW Department of Planning representative

The IMP was established under the Development Consent to:

- provide an overview of the independent audits required under condition 8.8(a) of the Development Consent;
- regularly review all environmental monitoring procedures undertaken by the Applicant and monitoring results; and
- provide an Annual Statement of the Environment Report for Lake Cowal with particular reference to the ongoing interaction between the mine and the lake and any requirements of the Director-General.

Construction activities commenced at the mine site in January 2004. Site visits were made to the mine site by members of the IMP before construction (Allen Kearns, 16-17 September 2003 and 22 November 2004) and after the commencement of construction (Clive Bell, 14-15 December 2004; Allen Kearns, 9 February 2006; Clive Bell and Allen Kearns, 3-4 July 2007; Clive Bell and Craig Miller, 29-30 July 2008).

The Director-General has not specified any requirements under condition 8.8(b)(ii) for the preparation of this report. This report covers site activities and environmental monitoring information provided to the IMP in the 2007 Annual Environmental Management Report (AEMR). The 2008 IMP Report includes the review of the Independent Environmental Audit Report (May 2008) for the period June 2007 to May 2008. The IMP also assessed additional material provided by Barrick Australia Ltd in the reports listed in Appendix 1.

OVERVIEW OF THE INDEPENDENT ENVIRONMENTAL AUDIT (IEA)

Under the Minister's Condition of Approval (MCoA) (26 February 1999), an Independent Environmental Audit was to be completed:

- six-monthly during construction;
- 12 months after commencement of ore processing;

- then every three years thereafter until decommissioning of the mine and ore processing operations, respectively, or as otherwise directed by the Director-General.

On this basis, there would not have been a legal requirement for an Independent Environment Audit Report for 2007/2008. In its report of August 2007, the IMP recognised that the template-based approach that had been used by Trevor Brown and Associates applied environmental management consultants (aemc) in the last four six-monthly reports leading up to the 2007 IMP reporting period was well-structured for addressing complex environmental compliance requirements, and was a good example of best practice for easily accessible and updated environmental compliance information. Thus the IMP made the following recommendation.

2007 IMP Recommendation 1: Because the next IEA is not due for three years, the IMP recommends that Barrick consider continuing use of the template-based approach established by aemc for environmental auditing of operations in order to regularly and systematically update progress on each of the environmental management and monitoring components. This approach would greatly assist the IMP in its annual review.

2008 IMP Assessment 1: Upon receipt of the 2007 IMP report, Barrick engaged aemc to undertake an Independent Environment Audit for the 12-month period to May 2008 using the same process and reporting approach as used in previous years.

A report was prepared by aemc and provided to the IMP for the period June 2007 to May 2008, which was the second 12 months of operation. The audit was undertaken over the period from 28 April 2008 to 2 May 2008.

The independent environmental auditors reviewed the available documentation covering licenses and approvals granted by Government for the project as well as the environmental monitoring documentation held by Barrick at the mine site office in order to verify compliance with the conditions of approval.

As mentioned in previous IMP reports, the independent environmental auditors established a logical framework for verifying compliance by setting out the entire list of requirements, in the thirteen separate management plans that have been prepared by Barrick, that cover environmental management under the Minister's Conditions of Approval. These separate plans include:

- Indigenous Archaeology and Cultural Heritage Management Plan
- Flora and Fauna Management Plan (amended 13 March 2008)
- Erosion and Sediment Control Management Plan
- Soil Stripping Management Plan
- Landscape Management Plan
- Bushfire Management Plan
- Land Management Plan
- Compensatory Wetland Management Plan
- Site Water Management Plan

- Hazardous Waste and Chemical Management Plan (amended 25 January 2008)
- Dust Management Plan (amended 31 August 2007)
- Blast Management Plan
- Noise Management Plan (amended 15 August 2007)
- Traffic Noise Management Plan (amended 16 July 2007)
- Cyanide Management Plan (amended August 2007)

The compliance by Barrick against the requirements of the above-listed plans was assessed by the Independent Environmental Auditors and comments were made against those approval conditions that had been activated. The same template-based approach had been used in the last four six-monthly reports prepared by aemc leading up to the 2007 IMP reporting period. The IMP recognised that this well-structured approach for addressing complex environmental compliance requirements continues to be an example of best practice for easily accessible and updated environmental compliance information.

The scope of the Independent Environmental Audit dated May 2008 included the following components:

- review of the implementation of the requirements of the development consent conditions, licences and approvals for the project for the operation of the mine and process plant;
- conduct of site inspections and review of on-site documentation and monitoring data relevant to the compliance audit;
- discussions held with project staff in relation to the development consent conditions;
- assessment of compliance of the project with the development consent conditions;
- preparation of an Independent Environmental Audit Report providing assessment of compliance against each consent condition.

The Independent Environmental Auditors (aemc) drew the following conclusions in their May 2008 report:

The audit findings confirmed a high degree of compliance with the Minister's Conditions of Approval, and requirements of the conditions attached to the Environment Protection Licence and Mining Lease.

The IMP has reviewed the reporting process used in the Independent Environmental Audit Report of May 2008. The IMP was easily able to independently assess and verify the status of environmental management information at the site and the high degree of compliance with development consent conditions, licences and approvals granted to Barrick, as reported by the independent environmental auditors.

During assessment of the Independent Environmental Auditors (aemc) report, the IMP noted the reference to the statement on the Erosion and Sediment Control Management Plan that "The ongoing management of erosion and

sediment control on the site and particularly the batters of the lake protection bund require review to ensure that the rehabilitation of the constructed surfaces is maintained for long-term stability." (page 7). The IMP independently assessed erosion and sediment control during its visit to the mine, and further comments on this issue are provided later in this report.

REVIEW OF ENVIRONMENTAL MONITORING PROCEDURES AND MONITORING RESULTS

The 2007 Annual Environmental Management Report (AEMR) was sent to the IMP on 6 June 2008. The 2007 AEMR covers the period 23 December 2006 to 22 December 2007. Overall, it is a well-structured and informative report prepared in accordance with the Department of Primary Industries – Minerals guidelines for AEMRs and in consultation with relevant stakeholders. The IMP made six recommendations in the 2007 IMP Report concerning environmental monitoring procedures, and these recommendations are assessed below in terms of adequacy of response by Barrick since the 2007 IMP Report. (These six recommendations are in addition to Recommendation 1 on the nature of the environmental auditing process.)

IMP Assessment of Response to 2007 IMP Recommendations

The IMP made six recommendations relevant to environmental monitoring procedures and the AEMR in the 2007 IMP Report as outlined below. Barrick responded to the Department of Planning (DoP) by letter on 29 April 2008 setting out its course of action for addressing all IMP recommendations.

2007 IMP Recommendation 2: The IMP suggests that the whole water management system is summarised in one section of the AEMR and that a water balance is established to track the stocks and flows of various sources of water entering the Cowal Gold Project.

2008 IMP Assessment 2: Although the AEMR has not been restructured to combine all water management in the one section, a water balance was included (Section 2.8) to show the stocks and flows for the mine. It is understood that the AEMR may need to be restructured after the Mine Act amendment in 2008.

2007 IMP Recommendation 3: In considering the redesign of the environmental monitoring programs at Lake Cowal, Barrick should consider the insights referred to in the three publications mentioned in this section (Batley et al. 2003; Kilgour et al. 2007; Field et al. 2007). One ongoing focal point for consideration needs to be on assessing the interactions between the mine and Lake Cowal as the lake inevitably undergoes major environmental changes expected when the lakebed finally floods again. A descriptive, and eventually predictive, understanding needs to be developed of the sequences of expected changes in biota, particularly bird life and fish populations as the lake floods. This information can be developed through consulting local people with knowledge as well as the scientific literature for the Lake Cowal environment and similar arid zone wetlands.

The aim of developing this conceptual understanding of how the Lake Cowal ecosystems would develop after flooding is to better understand the potential for adverse interactions between bird life and the mine site and to set in place improved environmental management practices that will limit the potential for unintended consequences.

2008 IMP Assessment 3: The CGM has developed a comprehensive, scheduled, monitoring program focussing on a range of environmental factors, in accordance with its Development Consent conditions, since 1999. The data collected has provided useful information on many of the baseline environmental conditions associated the region and the mine. However, the IMP and CGM have noted that it is necessary to refine the monitoring program to focus specifically on the potential impact pathways between CGM and Lake Cowal in both dry and wet conditions, and to identify conservative trigger points for pre-emptive remedial management action if such a trigger point is reached. The IMP has previously (2005) recommended that CGM adopt the ANZECC/ARMCANZ Water Quality Guidelines as the basis of its future monitoring program. This has been accepted by CGM and the Development Consent was modified accordingly in March 2008.

In a letter to the IMP (dated 17 October 2008; Appendix 2), Garry Pearson, Environmental Manager for CGM, has proposed that the relevant potential impact pathways are surface water flows from CGM into Lake Cowal and dust with its associated metals, and that the redesigned monitoring program will focus on these. The IMP concurs with the proposed revision to the Operations Monitoring Program, as set out in the letter.

2008 IMP Recommendation 1: That CGM immediately prepare a revised Operations Monitoring Program as proposed in the letter from Garry Pearson (17 October 2008) to the IMP. This program should set conservative trigger points and specify the remedial management actions that will be initiated should these triggers be activated. The IMP considers that the existing WAD cyanide monitoring-response process is an excellent model for this.

2007 IMP Recommendation 4: As the mine is not recommending any change in the frequency or methods of sampling or in the requirement to have samples analysed off-site by both local and NATA-accredited laboratories, the IMP recommends that the proposed amendments specified in the letter of 1 December 2006 from Barrick be accepted.

2008 IMP Assessment 4: The IMP notes that approval was given to Barrick on 24 October 2007 to use the Picric Acid method for on-site WAD cyanide level determinations in the Plant Laboratory for cyanide destruction monitoring purposes (AEMR Section 3.5.3.1).

2007 IMP Recommendation 5: That the Mine Geologist and Environmental Manager continue to monitor the waste rock being removed from the pit to ensure that pockets of potentially acid-generating material, which may have not been identified in previous core sampling, are identified and selectively placed within the waste rock dumps to preclude ARD generation. This requirement is

particularly important with waste rock being used to heighten the Lake Protection Bund.

2008 IMP Assessment 5: The IMP notes that the geochemical investigations of waste rock and tailings conducted for the 1998 EIS for the Cowal Gold Project and the subsequent additional geochemical investigations by Environmental Geochemistry International (2004) indicated that there was a very low likelihood of ARD generation from waste rock, CIL tailings and combined primary tailings.

It is noted by IMP in the 2007 AEMR that "The Mine Geologist and Environmental Manager are maintaining a watching brief on any discernible changes in ore and waste rock geology. Mineralogical and process plant surveys have also continued as performance improvement and energy efficiency opportunity tools. Processing performance has remained steady during the reporting period."

In response to the IMP's recommendation to remain vigilant on the issue of ARD, Barrick commissioned O'Kane-MESH Environmental to undertake further geochemical test work on waste rock emplacements and in-situ pit material. The results of this study (June 2008 draft report) confirmed the previous geochemical studies that the bulk of waste rock is Non-Acid Forming (NAF) with moderate Acid Neutralising Capacity (ANC). Additionally, the study confirmed earlier studies showing that the oxide waste materials are highly saline and that the primary rock can also be a source of salinity due to weathering. The report contained several recommendations which the IMP concurs with, namely –

2008 IMP Recommendation 2: Whilst no changes to current operational management of waste rock appear necessary, it is recommended that:

1. routine monitoring of waste rock pile run-off/seepage include monitoring for trace elements to confirm that soluble metal and metalloid loads from the waste emplacements are low,
2. additional waste rock geochemical infill programs are undertaken as mining progresses to verify the low potential for ARD and metal and metalloid leaching of waste rock excavated from the pit with depth, and
3. assess any geochemical changes occurring within the waste emplacements with exposure to surface weathering after a few years.

2007 IMP Recommendation 6: That consideration should be given, at this early stage of mine operation, to options for thickening of the tailings stream to:

1. ensure the recycling efficiency of water is improved and the area of exposed water is reduced for bird attraction, and
2. reduce the possibility of the tailings volume, over the predicted life of the mine, exceeding the volume of the two constructed tailings storage facilities.

2008 IMP Assessment 6: The IMP notes that, during the period since the last report, Barrick has engaged the services of a consultant (RMDSTEM) and has conducted in-house workshopping of water-saving options which targeted water recovery from the flotation tailings. Preliminary costing and technical risk

evaluation of process changes to improve water use efficiency have been undertaken, but no changes are planned for 2008. Consideration of a change to paste tailings is one of the options being considered in a future mine expansion (E42) for which approval has not yet been given.

2007 IMP Recommendation 7: That improvement is made to the visual presentation of groundwater data in the next AEMR.

2008 IMP Assessment 7: Barrick commissioned Parsons Brinckerhoff Aust Pty Ltd to produce a report titled "Cowal Gold Project – Hydrogeochemical Review of Groundwater System" (26 May 2008). In this report, the changes in shallow and deep groundwater levels across the mine and surrounds is shown in easily interpreted photos/figures. These water table contour figures are also presented in the AEMR 2007.

ISSUES IDENTIFIED BY THE IMP FROM THE 2007 AEMR, INDEPENDENT ENVIRONMENTAL AUDIT (MAY 2008) AND MINE VISIT (29-30 July 2008)

Erodibility of Slopes of Waste Emplacements and Tailings Storage Facilities

The Independent Environmental Audit indicated that the Lake Protection Bund is showing significant erosion. The mine visit by the IMP also identified significant erosion on the Bund, with extensive rilling leading to considerable sediment transport to the base of slopes. The surface materials are exhibiting characteristics of highly dispersible solids.

In conjunction with the Australian National University, the mine has established erosion control research plots on the inside of the Lake Protection Bund to provide guidance of the best method(s) for controlling erosion. Treatments included various organic and rock mulches. Useful data has been obtained from this research, but low rainfall over recent years has affected vegetative growth on the plots.

The IMP also noted that, while some areas of the walls of the tailings storage facilities (TSFs) were covered with a stabilising plant cover, in other areas vegetative establishment has been poor, and there was also evidence of rilling due to the dispersive nature of the surface material.

It is apparent that the erosion control strategies for the Lake Protection Bund, Waste Rock Emplacement areas and the TSFs need to be reassessed in the light of the observed surface stability of these structures. The input of a person (or persons) with experience and track record in the design and rehabilitation of mined landforms involving dispersible material may be of benefit.

2008 IMP Recommendation 3: The erosion control and restoration strategies for the Lake Protection Bund, Waste Rock Emplacements and Tailings Storage Facilities should be reviewed as a matter of urgency. While the IMP acknowledges the engineering constraints and logistic advantages behind the construction of stable graded bund walls, we note that it is essential to incorporate roughness and complexity at multiple scales into the design of these walls if they are to a) minimise sheet or rill erosion, and b) sustain native

vegetation. Such roughness can be created, for example, by placing a mulch of competent rock on surface soil.

Revegetation of these walls will continue to be a challenge. It is essential that CGM is clear about the goals of revegetation, as these will determine the various stages and potential pathways. For example, establishing a quick grass cover may be facilitated by the use of fertiliser, but this will also favour exotic weeds rather than native species. Mulching will be useful for retaining moisture and providing soil organic matter, but it may have to be planted into, as it can inhibit the establishment of some seedlings. Again, roughness and complexity will be key factors in the successful rehabilitation of these walls.

The engagement of a person or persons with practical experience in dealing with the rehabilitation/stabilisation of landforms comprising highly dispersible materials to work with mine and University personnel on this issue is strongly recommended.

Metal and Metalloid Concentrations in Dust

As indicated in the 2007 IMP report, the IMP supports the initiation of the research program conducted through the University of Sydney to (1) determine the presence of dust accessions within the local Lake Cowal Region, (2) assess the distribution, and amalgamation effect, of dust additions to the soil profile in this region, and (3) establish and monitor baseline dust metal concentrations.

Assessment of the most recent report from the University of Sydney and the AEMR shows that there are several anomalies in the data for metal contents of dust samples, e.g. zinc, lead, cadmium and copper. The data for zinc and lead for some samples appear excessively high, perhaps as a result of contamination, whereas the anomalies for cadmium may be related to a change in laboratory.

Copper concentrations of dust listed in the University of Sydney report were all below the detection limit (1 mg/kg). However, the total copper levels cited in the reports by OKC/Mesh (June 2008) and GEM (June 2008) for oxide and primary rock range from 5-648 mg/kg. Additionally, textbooks list total copper concentrations in soils to be in the range 2-60 mg/kg with a mean of the order of 30 mg/kg. There would be merit in reassessing the copper levels in the dust samples collected in the University study.

2008 IMP Recommendation 4: The reasons for the anomalous results for metals in dust samples collected at the mine need to be determined and steps taken to ensure confidence in future analyses. It is suggested that the mine prepare a homogenous bulk sample of several kilograms of each of "representative" (1) surface soil, (2) subsoil, (3) oxide waste and (4) primary rock. These samples should be sent to at least three reputable laboratories used by the mining industry for analysis of the range of metals (and metalloids) of particular interest at the Cowal Mine and the mean results collated. Thereafter, when dust samples are sent to a given laboratory, a sample of each of the "standards" can be included as blind samples as a check on quality control.

ANNUAL STATE OF THE ENVIRONMENT REPORT FOR LAKE COWAL

The IMP is required to provide an Annual State of the Environment Report for Lake Cowal with particular reference to the on-going interaction between the mine and Lake Cowal.

Lake Cowal continued to be dry during 2007 as a consequence of the prolonged drought affecting the central west region of NSW and eastern Australia in general. Consequently, there was no surface water sampling results available for review by the IMP. Observations of bird breeding activity and bird habitat in January, August and October 2007 was undertaken by Paul Peake from University of Adelaide as part of his ongoing observations first established in 1989. He reported that the lake was dry, and that no waterbirds were present except for nine birds on a farm dam on 21 August 2007.

The AEMR (p.86) stated that “a significant portion of bird breeding area (2,200 ha) was burnt out during the 19-20 November 2006 bushfire that originated from a camp site at Bogey’s Island. The northern bird breeding area post 2006 was devoid of much of the prior vegetation, and habitat value has been detrimentally affected as a result. In 2007 the drought continued with lignam returning to the bird breeding area. However, the effects of the bushfire, combined with the prevailing dry Lake conditions has restricted potential bird breeding in the area.”

Finally, Condition 8.8(b)(ii)(c) requires the IMP to respond to "any requirements of the Director General". To date, the IMP has not been provided with any information or requests on other “requirements of the Director General”.

SUMMARY LIST OF IMP RECOMMENDATIONS FOR 2008

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INDEPENDENT MONITORING PANEL

Emeritus Professor L. Clive Bell
University of Queensland
Former Executive Director, Australian Centre for Minerals Extension and Research (ACMER)

Dr Craig Miller
Stream Leader – Biodiversity Conservation, Management and Implementation, CSIRO Sustainable Ecosystems

APPENDIX 1 – LIST OF REPORTS ASSESSED BY INDEPENDENT MONITORING PANEL

Cowal Gold Project – 2007 Annual Environmental Management Report (30 May 2008). Barrick Australia Limited.

Cowal Gold Project – Independent Environmental Audit (May 2008). Trevor Brown and Associates (aemc).

Waste Rock Geochemical Infill Programme – Cowal Gold Mine. OKC/MESH Report No. 774/1-01 (June 2008).

Tailings and Waste Rock Geochemical Assessment (E42 Modification) (DRAFT). Geo-Environmental Management Pty Ltd (June 2008).

Cowal Gold Project – Hydrogeochemical Review of the Groundwater System. Parsons Brinckerhoff Australia Pty Limited (26 May 2008).

Interpretation and Discussion of 2007 Air Quality Monitoring Results – Cowal Gold Project. Dr Stephen Cattle, University of Sydney (undated).

Review of Cowal Gold Mine Operations Monitoring Program. Environmetrics Australia Pty Ltd (June 2008).

Cowal Gold Project – Mine Operation Noise Monitoring. Heggies Pty Ltd. (Report 10-4111-R4, January 2007; Report 10-4111-R5, July 2007; Report 10-4111-R6, September 2007).

Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Facility: October 2006 to March 2007. Donato Environmental Services (August 2007).

Seasonal Wildlife Use Patterns of the Cowal Gold Mine Tailings Facility: April to September 2007. Donato Environmental Services (February 2008).

Compensatory Wetland Regeneration Monitoring Report. Belinda Jamieson, Cowal Gold Mine, Barrick Australia Limited.

Summary of Results of Mulch Trial (June 2007-May 2008) at Cowal Gold Mine, NSW. Jenny Smits, Australian National University (May 2008).

Rehabilitation and Landscape Management Strategy. E42 Modification. Barrick Cowal. ID No. 00085384.doc (June 2008) (DRAFT).

APPENDIX 2 – LETTER FROM GARRY PERSON TO IMP

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WEST WYALONG NSW 2671
NSW AUSTRALIA

Tel: (02) 6975 4700
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COW.400.10.1933GP
(COW.400.05.01.1934GP)

17 October 2008

Professor Clive Bell
Australian Centre for Minerals Extension and Research
PO Box 883
KENMORE QLD 4069

Dear Clive,

RE: Cowal Gold Mine – Revision of the Surface, Ground Water, Meteorological and Biological Monitoring Programme

As you are aware The *Cowal Gold Mine Surface Water, Groundwater, Meteorological and Biological Monitoring Programme – Mine Operations* (Operations Monitoring Programme) (Barrick, 2005) was prepared by Barrick Australia Limited (Barrick) in accordance with Conditions 8, 8.1, 8.2(a)(ii) to (iv) and 4.1/4.2(a)(i) and (viii) of the Cowal Gold Mine (CGM) Development Consent.

In accordance with the Development Consent conditions, the Operations Monitoring Programme provided for the continuation of baseline monitoring conducted prior to the grant of the Development Consent in 1999. The design of the baseline monitoring programme, in relation to the surface water and biology of Lake Cowal, was based on a document prepared by the CSIRO in 1991; *Principles and Guidelines for a Biological Monitoring Program in Lake Cowal* (Humphries, *et al.,* 1991).

Development Consent Modification

In March 2008, the Development Consent was modified to remove the requirement to continue baseline monitoring and enabled the Operations Monitoring Programme to adopt the *ANZECC/ARMCANZ Water Quality Guidelines* as its basis.

Justification for the Development Consent modification included:

- the adoption of the *ANZECC/ARMCANZ Water Quality Guidelines* is in accordance with the recommendations made by the Independent Monitoring Panel (IMP) in their 2005 report;
- the adoption of the *ANZECC/ARMCANZ Water Quality Guidelines* is aimed at improving the Operations Monitoring Programme;
- cessation of baseline monitoring would not decrease Barrick's ability to detect any potential adverse environmental impacts from the Cowal Gold Mine.

Current Development Consent conditions are reproduced below for your information:

> *8.2 Surface and Ground Water and Cyanide*
>
> *(a) Water monitoring*
>
> *…(iii) The monitoring program will include the development of adequate chemical and biological monitoring in the waters of Lake Cowal, when water is present, by suitably qualified and experienced staff or consultants to the satisfaction of the DWE and DECC, and in the case of biological monitoring DPI(Fisheries). DWE and DECC must be satisfied as to sampling design, including sample locations, sample frequency, sample handling, transport and analysis, sampling parameters and reporting of analysis results.*

Operations Monitoring Programme Revision

The Operations Monitoring Programme is proposed to be revised in accordance with the abovementioned modified Development Consent condition and consistent with the IMP's recommendations made during their 2005, 2006 and 2007 review periods *viz:* "*with a view to reviewing options and possibly developing a more useful and effective scaled-down environmental monitoring system*".

To this end, Barrick engaged Professor David Fox of Environmetrics Australia to undertake a review of the Operations Monitoring Programme. Professor Fox reviewed the baseline monitoring data for comparisons against future monitoring results and concluded that: "*Monitoring of baseline conditions (i.e. prior to the commencement of construction of the Cowal Gold Mine) appears to be fragmented, episodic and somewhat opportunistic. This has resulted in a series of instantaneous 'snapshots' rather than a comprehensive assessment of pre-mine conditions. The results of a statistical analysis of baseline surface water data…shows that unless data are substantially aggregated, the baseline monitoring effort is very sparsely distributed in space and time*".

Consistent with the above, Barrick propose to revise the Operations Monitoring Programme by removing direct reliance on the deficient baseline monitoring programme by:

(a) adopting an ANZECC/ARMCANZ approach to the assessment of potential impacts on Lake Cowal resulting from the CGM;

(b) focusing monitoring so it is relevant to the potential impact pathways from the CGM to Lake Cowal; and

(c) providing for a more useful and effective scaled-down biological monitoring component.

Relevant Potential Impact Pathways

Monitoring parameters which are relevant to potential CGM impact pathways would provide direct information on the contribution of the CGM to the status of the Lake Cowal environment. The relevant potential impact pathways include surface water flows from the CGM to Lake Cowal and dust from active mine areas on to the Lake.

As determined by the *Long Term Compatibility Assessment Studies* (Appendix N of the EIS) (North Limited, 1998), other potential impacts have been considered, however are not relevant to potential effects on Lake Cowal because of CGM design elements. These included:

- Potential connection between Lake Cowal and the final void via spillage, seepage and bund and final void instability. These were discounted considering the design principles of CGM isolation from Lake Cowal and inherent conservatism of the design to allow for infrequent events (eg earthquake); and
- potential influence to Lake Cowal water quality from waste rock emplacement and tailings storage facility seepage (including heavy metals and residual cyanide). This was discounted considering the preferential groundwater flows to the open pit/final void and the low permeability base drainage control zone which directs waste emplacement seepage to the open pit/final void.

Surface Water Flows

The CGM water management system is designed to isolate the CGM from Lake Cowal by containing potentially contaminated water (contained water) generated within the mining area within an Internal Catchment Drainage System (ICDS), constructing barriers between the lake and the CGM and diverting all other water around the perimeter of the site.

Mine infrastructure and landforms have been constructed within the Internal Catchment Drainage System (ICDS). The ICDS consists of contained water storages for CGM runoff collection (i.e. D1, D2, D3, D4, D5, D8A and D8B) and the internal catchment divide (i.e. a bund constructed on the outer bounds of the CGM catchment to direct runoff toward the contained water storages).

The ICDS combines with the lake isolation system (which comprises the temporary isolation bund and permanent lake protection bund) to isolate Lake Cowal from mine development activities. The lake protection bund comprises a large engineered embankment that provides a permanent barrier between Lake Cowal and the open pit. Runoff from areas upslope of the ICDS is diverted via an Up-catchment Diversion System (UCDS), around the mine area to Lake Cowal.

The only potential influence on Lake Cowal water quality from CGM runoff could be via overflow from contained water storages D1 and/or D4 (which collect water from the outer batters of the northern and southern waste emplacements, respectively), during a rainfall event which exceeds the approved design capacity of these storages (i.e. 1 in 100 year annual recurrence interval 48 hours duration).

Dust

Dust and/or metals in dust from active mine areas could potentially affect the water quality and bed sediments of Lake Cowal. Emissions associated with operation of the CGM are primarily derived from the mechanical disturbance of soils and waste rock when using conventional mining equipment.

Relevant Parameters to be Monitored

Parameters relevant to the abovementioned potential impact pathways which would continue to be monitored include:

- Lake Cowal surface water quality (relevant to potential surface water quality impacts) (as part of the surface water monitoring component of the Operations Monitoring Programme). In addition, the revised Operations Monitoring Programme would continue to include monitoring of other contributing sources from the Lake Cowal catchment (i.e. the Lachlan floodway, irrigation channel, Bland Creek and Sandy Creek inflow sites).
- Surface water quality within contained water storages D1 and D4 (relevant to potential surface water quality impacts) (as part of the surface water monitoring component of the Operations Monitoring Programme).

- Dust deposition levels within Lake Cowal (as a part of the Dust Management Plan [DMP] [Barrick, 2003]) (relevant to potential dust deposition impacts). Dust monitoring site DG5 has been positioned near the centre of Lake Cowal so that it remains within the surface water area under a range of lake water level conditions. Monitoring at DG5 and other dust deposition gauges located in and around the lake would continue to provide results representative of potential dust impacts on any surface waters within the high water mark of Lake Cowal.
- Metals in dust samples taken within Lake Cowal (as a part of the DMP) (relevant to potential dust deposition impacts).
- In addition to the above, analyses of sediment taken from lake monitoring points would be undertaken to assess the bioavailability of metals within the bed of Lake Cowal. The water quality monitoring programme and sediment monitoring programme would combine to provide data relevant to the bio-availability of parameters and comprise the biological monitoring component of the Operations Monitoring Programme). The sediment monitoring programme would be relevant to potential surface water quality and dust deposition impacts. The revised Operations Monitoring Programme would include sediment monitoring during both lake "dry" and "wet" periods, where practicable.

Additionally, the revised Operations Monitoring Programme would continue to include monitoring for a range of locations and frequencies of parameters, including:

- Surface water monitoring, including:
  - surface water quality within contained water storages, pit sumps and sediment control structures within the ML;
  - Lake Cowal water level at the Lake Cowal gauge board;
  - Lake Cowal inflow quality at Lake inflow sites; and
  - surface water quality of other waters (e.g. temporary pond [lake isolation system]).
- Groundwater monitoring, including groundwater quality and water levels at various monitoring sites locally (within the ML) and regionally.
- Meteorological monitoring at the CGM meteorological station.

Data Usage

Surface Water

The default high conservation/ecological value protection level triggers (including the 99% protection level for toxicants) provided in ANZECC and ARMCANZ (2000) would continue to be used to trigger surface water investigations, as described in Section 8 of the current Operations Monitoring Programme:

> *The default high conservation/ecological value protection level triggers (including the 99% protection level for toxicants) provided in Chapter 3 of ANZECC and ARMCANZ (2000) (refer to the SWMP) will be used to trigger surface water investigations, as described in the Section 4.3 until such time as Project specific triggers (based on lake water quality monitoring results across a range of storage and seasonal conditions) are developed in accordance with the procedures presented in ANZECC and ARMCANZ (2000) and in consultation with the relevant authorities.*

Dust

Monitoring at DG5 and other dust deposition gauges located in and around the lake would continue to provide results representative of potential dust impacts on any surface waters within the high water mark of Lake Cowal.

In addition, composite dust samples would continue to be analysed for select metals (i.e. aluminium, arsenic, cadmium, copper, lead, selenium and zinc) at six monthly intervals for comparison to average crustal abundance levels (Bowen, 1979) in accordance with the DMP.

Further, analysis of surface water monitoring results in conjunction with dust deposition monitoring data would provide for monitoring of the potential impacts of dust on any surface water within the high water mark of Lake Cowal. For example, the relative dust deposition results at sites DG3 and Site 52 would allow comparison of dust deposition levels within the high water mark of Lake Cowal, both immediately adjacent to the mine and at the opposite side of the lake. If surface water is present, water monitoring results from water quality monitoring sites adjacent to the mine and at the opposite side of the lake can similarly be compared and any differences in water quality examined in light of the dust monitoring data (including metals concentrations in dust and surface waters).

Sediment

Sequential extractions can be a useful tool to acquire information on the phase associations of metals in sediments. As certain phases are considered more bio-available than others, sequential extractions can also give an indication of the bioavailability of the metals being studied. Sequential extractions of selected sediment samples would be undertaken to assess the bio-availability of the copper, cadmium, zinc, lead, arsenic and mercury.

The concentration of metals in sediment taken from lake monitoring points would be assessed against the recommended sediment quality guidelines defined in ANZECC and ARMCANZ (2000) and presented in Table 1.

Table 1

Sediment Contaminant Trigger Values

Parameter	Trigger Value (mg/kg dry weight)
Arsenic	20
Cadmium	1.5
Copper	65
Lead	50
Mercury	0.15
Zinc	200

Source: ANZECC and ARMCANZ (2000)

If the trigger values in Table 1 are exceeded, an investigation would be undertaken in accordance with the methodology described in Section 3.5.5 of ANZECC and ARMCANZ (2000). This monitoring would include consideration of baseline sediment concentrations.

Path Forward

Could you please advise whether you consider this proposed approach for revision of the Operations Monitoring Programme (to focus monitoring so it is relevant to the potential impact pathways from the CGM to Lake Cowal and provide for a more useful and effective scaled-down biological monitoring component) is acceptable to the IMP. If the approach is acceptable to the IMP, Barrick will prepare a draft revised Operations Monitoring Programme and provide it to the IMP and other appropriate regulators in accordance with the consent condition requirements, for review.

Please do not hesitate to call should you have any queries.

Yours faithfully
Barrick Australia Limited

GARRY PEARSON
Environmental Manager

Copies:
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