Monitoring the monitor: a temporal synthesis of the McArthur River Mine
Independent Monitor reports

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Philippa Higgins¹, Martin Andersen¹, Cameron Holley¹, Kirsty Howey², Fiona Johnson¹, Matthew Kearnes¹, Stuart Khan¹, Greg Leslie¹ and Shar Molloy²

¹ UNSW Global Water Institute, University of New South Wales, Sydney
² Environment Centre of the NT, Darwin
Summary

The recent approval to expand Glencore’s McArthur River Mine (MRM) lead-zinc-silver mine is the latest in a long history of decisions by the Northern Territory’s Mining Regulator which have resulted in unacceptable risks to the Northern Territory environment and the downstream community of Borroloola.

Despite the oversight of an Independent Monitor assessing the environmental impacts at, and downstream of, the mine site annually, the regulatory process has failed to protect the interests of the environment and the community. Short term impacts, including the spontaneous combustion of waste rock in the northern overburden emplacement facility (NOEF) from 2014 – which was the focus of extensive media reporting - are likely minor compared to the long-term risk of contamination from acid and metalliferous drainage (AMD) to the groundwater system and the McArthur River.

The UNSW Global Water Institute (UNSW-GWI) and the Environment Centre of the Northern Territory (ECNT) has undertaken a longitudinal assessment of the publicly available information on water-related issues at MRM over the period 2007 – 2018. This analysis shows repeated failures on behalf of the mine site Operator and Mining Regulator to act in a timely manner to address risks to sensitive aquatic environments. In this summary report, UNSW-GWI highlight three of the key risks to water resources to exemplify deficiencies in the regulatory system and propose improvements to protect the interests of the community going forward. A comprehensive assessment of all project risks is undertaken in the IM reports listed in the references.

Key findings:

- There are a number of technical issues related to water around MRM that are not being adequately addressed and have the potential to lead to adverse environmental impacts. These include inadequate baseline monitoring of sacred sites and assumptions around the chemical composition of water leaking from the mine tailings storage facility.

- The IM process is not as effective as it should be because:
  - There is a significant delay between the reporting period and the release of the IM reports. In addition, the IM reports are limited in scope to an annual synthesis with minimal reporting of trends over multiple years;
  - Recommendations and potential issues of concern identified by the IM are not acted on quickly enough by the Operator or the Mining Regulator;
  - The IM does not have access to all data from MRM so cannot fully assess all risks. For example, the impacts of MRM on some sacred sites have not been considered at all;
  - Community engagement within the IM process is limited; and
  - The IM reports are frequently released at the end of the year, meaning that their impact and potential to improve community understanding of the impact of MRM operations is diminished due to the holiday season with the focus of stakeholders and the public being diverted.
Introduction
The McArthur River Mine (MRM) is situated in the remote Gulf of Carpentaria, 970 km southeast of Darwin. MRM has been producing and processing zinc, lead and silver for export since 1995. The appointment of an Independent Monitor (IM) was a condition of the approval for the transition to open cut pit mining in 2006. The IM provides independent oversight of the environmental performance of the mine Operator, and the performance of the Department of Industry, Trade and Tourism (DITT; formally the Department of Mines and Energy and the Department of Primary Industry and Resources) as the environmental Mining Regulator. This oversight was a commitment made by the Northern Territory Government to address community concerns around future mine impacts.

Annual assessment reports from the IM, who is appointed for a 5-year term, address the operation of the mine over the previous year. The reports consider any environmental assessments and monitoring activities undertaken by the Operator, and document environmental performance, identify issues requiring urgent attention, and provide recommendations to address environmental risks. A Community Report summarising the findings is also released. There are nine publicly available IM reports covering operations at MRM from October 2007 to present, although the reports assessing the period April 2018-March 2019 and April 2019-March 2020 are overdue. These reports contain a significant volume of data, technical information, and interpretation and could be a valuable contribution to mine site regulation, if, as discussed below, the environmental issues that are identified in the reports are quickly acted upon, and processes of community engagement are addressed.

The IM reports show that some environmental management requirements have been met at MRM, and monitoring and management has improved over time, particularly in relation to dust and its impact on surface water quality and aquatic fauna.

However, the lack of timely action on urgent issues raised by the IM has resulted in long-term and unacceptable impacts to the community and environment. By reviewing all the IM audit reports, it is apparent that inefficiencies and flaws in the regulatory process decrease the effectiveness of the IM audits as a tool to facilitate better environmental management. To indicate the scale of this issue, the latest IM audit report noted 117 ongoing IM recommendations “that have either been partially addressed or not advanced at all” by the Operator and Mining Regulator [ERIAS, 2018b; pg. 5-7].

This report shows that regulatory action is lagging – in many cases by years - behind the disclosure of significant environmental risks by the IM. Three specific examples of water-related risks below illustrate how the IM reports have been ineffective to protect the environment and community concerns as intended.

Water-related risks

a) Acidification of tailings storage and waste rock misclassification

Plain Language Summary
Rock left over from the mining operations is stored in a big pile. MRM originally said that most of the leftover rock did not have any chemicals in it that would mix with water and air to possibly form acids. However, the IM found as early as 2008 that this assumption might be wrong, and that acid might have been forming. This is important because rock that can form acid needs to be stored differently from benign rock. We think it took too long for these early IM concerns to be addressed by MRM and therefore the rock was exposed to water and air for longer than it should have been. However, no government action was taken until the waste rock dump began smoking in 2014, when the Operator was asked to submit an environmental impact statement (EIS). The Mining Regulator approved the Operator’s proposal to fix the problem in December 2020. This lag

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of 12 years between the problem being identified, and eventually resolved by the Mining Regulator shows that the IM does not have sufficient power to improve the environmental outcomes from the mine quickly.

Technical Summary

Regulatory failure at MRM is exemplified by the waste rock misclassification, which resulted in acid and metalliferous drainage from the overburden emplacement and tailings storage facilities, and the spontaneous combustion of waste in the northern overburden emplacement facility (NOEF) and visible sulphur dioxide plumes. These events triggered an Environmental Impact Assessment process in 2014 (with the EIS not submitted by the Operator until 2017, and an assessment report delivered by the Northern Territory Environment Protection Authority in 2018) to redesign the waste rock management facility for mine closure and rehabilitation.

Until 2014, the system used to classify waste rock by the Operator did not match the actual characteristics of the rock being mined, which led to a significant underestimation of the volume of environmentally non-benign waste rock (rock with the potential to generate acidic, pH neutral metalliferous, and/or saline drainage). Following the 2014-2018 EIS process, the approval of the mine’s proposal for rectifying this issue did not occur until December 2020. Consequently, for many years a significant portion of the waste rock and tailings was not managed appropriately to avoid or minimise oxidation and AMD generation. Identifying urgent environmental issues like AMD and notifying the Operator and Mining Regulator is a key function of the IM. If the audit process was adequate, it should not have taken twelve years to address deficiencies in the waste rock classification and the management of the non-benign waste rock.

By reviewing the assessment reports, it is clear that the IM identified and communicated concerns over the waste rock classification in all audits beginning with the 2008 operational period. The IM identified that tailings appeared to be oxidising rapidly and producing sulphuric acid [EES, 2009; pg. 70] and that the assessment of tailings as non-acid forming was likely incorrect [EES, 2009; pg. 71]. Multiple recommendations to further assess tailings and overburden geochemistry were made, including large scale field weathering trials, additions to the groundwater quality testing analytical suite, and re-evaluation of the waste rock classification [EES, 2009; pg. 77]. Commitments by MRM to undertake further kinetic testing and field trials were unmet by the release of the 2009 operational period audit report [EES, 2010; pg. 66-67] and the IM reiterated that these should be undertaken urgently. Further statements of concern regarding potential errors in the waste rock and tailings classification were made in the 2010 [EES, 2011; pg. 9, 122, 124-129] and 2011 [EES, 2012; pg. 145-149] IM audit reports.

New geochemical investigations into the waste rock classification began in September 2012, however the results were not released before the approval of the MRM Phase 3 Expansion in 2013 which increased the mining rate from 2.5 Mtpa to 5.5 Mtpa of ore and the capacity of the tailings storage facility. A major change to the waste rock classification was released in 2014 [KCB, 2014] and reviewed in the 2012-13 operational period IM audit report [ERIAS, 2014; pg. 98-112]. The reclassification revised the proportion of waste rock with the potential to generate AMD from less than 25% up to 89%. In recognition of the significant risk of environmental impacts due to the inappropriate design of the waste rock facility to contain the increased volume of non-benign waste, the NT Environmental Protection Agency requested a new EIS. The Operator’s proposal to rectify the problem (originally submitted for assessment in 2017) was not approved by the Mining Regulator until December 2020, some 12 years after the problem of misclassification of waste rock was identified by the IM.

b) Seepage reporting to Surprise Creek

Plain Language Summary

Mine tailings are a mix of water and solids like rock that are left over from extraction of the ore. Mining tailings are stored in a big dam (called the Tailing Storage Facility) which is designed so that the water can either be evaporated off or treated before being reused in the mine or discharged to the environment. At MRM, the water is leaking from underneath the tailings storage through the ground and into Surprise Creek which is close to where the tailings are stored. Surprise Creek joins Barney Creek west of MRM which then joins the McArthur River downstream of the mine. The leaking water into Surprise Creek is a problem because the
water may also carry some metals and we do not think that MRM or the IM have done enough testing to fully understand this. The tailings currently in storage will be there until at least 2047. MRM has tried different ways to stop the water reaching the creek, but none have been completely successful. The water leaking from the storage has also made Surprise Creek flow all year; it used to flow for only part of the year.

**Technical Summary**

Waste rock misclassification and the acidification of tailings is a direct risk to both the groundwater and surface water. The tailings storage facility (TSF) is close to Surprise Creek, a tributary of the McArthur River. Leachate migration from the unlined Cell 1 through highly permeable alluvium to the creek is known to have occurred within two years of commencement of tailings deposition (c. 1997) [EES, 2009; pg. 26]. Despite installation of mitigation measures including a ‘geopolymer’ barrier system, seepage recovery bores, and partial capping of inactive cells, seepage from the TSF and migration to Surprise Creek continues to be an issue at MRM. Ongoing seepage has resulted in a change to the hydrological conditions in Surprise Creek. Previously intermittent, the part of the creek down gradient of the TSF now receives year-round baseflow from wastewater seepage [KCB, 2017a; pg. 90].

The IM identified leachate migration as an issue of urgent concern, resulting in a notification under Section 6.4 of the Independent Monitor Assessment Conditions (letter dated 6 July 2009) requesting further hydrogeochemical investigation into the issue. There have been concerns over both the timeliness [EES, 2010; pg. 75] and quality [EES, 2011; pg. 40-43] of these investigations, however further investigations mean the mechanisms of seepage are now well understood.

Information available to date (up until March 2018) indicates process water rather than oxidation of tailings is the source of contamination from the TSF, resulting in neutral metalliferous leachate [ERIAS, 2017; pg. 4-161]. However, the tailings are highly pyritic and potentially acid forming, and acidic leachate with high metal/metalloid concentrations is a risk if oxidation is not controlled [ERIAS, 2018b; pg. 4-144]. Assessments of metal plume migration [KCB, 2017a; 2017b] are based on the assumption that seepage remains neutral. If seepage acidifies, trace metals such as lead, zinc and cadmium may become mobile at pH values between 3-5. At higher pH values they tend to adsorb to sediment surfaces and not be mobile. Provided the seepage doesn’t acidify, i.e., there is sufficient buffering from minerals in the sediment (e.g. carbonate minerals like calcite or dolomite), some trace-elements that form oxyanions like arsenic (As) may still mobilise. Natural dissolved organic matter (NDOM) can potentially make the groundwater system anoxic and release As by reductive dissolution of Fe-oxides which are otherwise attenuating As at neutral and high pH. The potential role of NDOM, in particular in relation to As migration, does not appear to have been evaluated in the laboratory testing or the modelling.

The recently approved Overburden Management Project (to which the 2014-2018 EIS relates) proposed to reprocess tailings and dispose of them in the mine pit void at the cessation of mining, removing the TSF [GHD, 2017]. Under this proposal, the TSF will remain as a potential source of contamination to Surprise Creek and the McArthur River until 2047. The construction of a seepage interception trench between Cell 1 and Surprise Creek for seepage mitigation is underway [MRM, 2020; pg. 69], but under the best-case scenario the trench will not prevent all contaminant loads from reaching Surprise Creek [KCB, 2017 a; Appendix I pg. 64], and migration of deeper groundwater beneath the trench is likely [ERIAS, 2018a; pg. 3-4].

c) Risks to Sacred Sites

**Plain Language Summary**

There are 11 registered sacred sites and another 11 recorded sacred sites inside or close to MRM. For the 11 registered scared sites, 4 are related to water and 2 are trees but the impacts of MRM are only assessed for one site (Djirrinmini waterhole). We think that this is unacceptable and all impacts on all sacred sites should be considered. For Djirrinmini waterhole, we do not think that enough data is being collected and released to the public to be able to tell if the mine is impacting the waterhole.
Technical Summary

The Northern Territory Aboriginal Sacred Sites Act 1989 (the Act) protects sites that are 'sacred and otherwise of significance in the Aboriginal Tradition'. There are 11 registered sacred sites - sites documented and evaluated by the Aboriginal Areas Protection Authority (AAPA) and entered into the Public Register of Sacred Sites in accordance with the Act - within and in the vicinity of the mine site. There are a further 11 recorded sites, which have not been evaluated or added to the register, but for which information indicates that they are significant according to Aboriginal tradition and therefore "sacred sites" within the meaning of the Act.

Water related sites including rivers, creeks and springs, and groundwater dependent trees are at risk from both groundwater drawdown resulting from dewatering of the mine pit and mitigation measures for managing the TSF, and contamination from AMD. Of the 11 registered sites, four are water related, and two are trees. However, only the impacts to a single water-related site, Djirrinmini waterhole, have been considered during the EIS process.

Djirrinmini is a permanent waterhole located on the McArthur River upstream of the mine site and is reliant on baseflow during the dry season. Djirrinmini may also be a breeding site for freshwater sawfish and is likely an important refugia for aquatic fauna during the dry season. Groundwater modelling undertaken as part of the 2014-2018 EIS process predicts up to 0.4 m of drawdown in the overburden and weathered bedrock and up to 0.65 m of drawdown in the fresh bedrock adjacent to Djirrinmini waterhole [KCB, 2017a; pg. 217-18]. The magnitude of impact is consistent with investigations undertaken for the previously approved Phase 3 Project EIS in 2012 [KCB, 2017a; pg. 5], but lower than MRM Site-Wide Groundwater Model developed in 2013 which predicted up to 2 m of drawdown adjacent to Djirrinmini. An explanation for the difference in predicted drawdown between the 2013 and current groundwater modelling results and the estimated uncertainty in the prediction values have not been provided. The potential risk and impacts of different levels of drawdown to the physical and ecological functioning of Djirrinmini has not been assessed.

There is inadequate baseline monitoring of Djirrinmini to assess the potential impact of predicted groundwater drawdown, which has been raised in several IM reports [EES, 2009; pg. 43, ERIAS, 2014; pg. 197, ERIAS, 2015; pg. 4-202]. Only one alluvial bore (GW74) was available at Djirrinmini for the groundwater investigations underpinning the OMP, and records were sparse except for a two-month period during the 2013/14 wet season [KCB, 2017a; pg. 47]. Surveys of the dry and wet season extents of the waterhole have not been undertaken. Additional loggers recording high frequency groundwater level and EC readings have been recently installed near the waterhole [ERIAS 2018b; pg. 4-120], however the location of or data from these instruments has not been released publicly. Potential impacts to other water-based sacred sites, such as Nambadini, a waterhole 300 m north of Surprise Creek potentially within the zone of impact of seepage from the TSF, and the Garbula tree, which is in close proximity to the mine pit and may be affected by pit dewatering, have not been considered.

Condition 30 of the Variation of Authorisation 0059 for the Overburden Management Plan states that “At all times the Operator must conduct works consistent with the Northern Territory Aboriginal Sacred Sites Act 1989 and valid AAPA certificate”. Further, Condition 32 requires a consultation plan with ‘appropriate custodians and traditional owners that would be or may be impacted by the Overburden Management Project’ to be provided within six months of approval. It is not clear how these impacts to Djirrinmini or other sacred sites could be comprehensively assessed in the absence of the information outlined above.

Discussion and recommendations for process improvements

The three technical issues described in this report highlight three different types of problems with the current system of environmental management and environmental oversight of MRM. They are:

1. The process for addressing IM concerns is too slow and as a result adverse environmental impacts continue for many years until they are addressed and may continue for decades or centuries into the future.
2. MRM is too optimistic in the assumptions that are made about the characteristics of the mine waste and the technical solutions that are available to address current problems.

3. MRM has not comprehensively considered impacts to all systems, particularly with regard to the ecological and cultural values of waterbodies.

4. Insufficient baseline data is available.

The results presented in this report are consistent with earlier analyses of MRM and the IM. For example, in his report for the Mineral Policy Institute, Mudd (2016) found that “overall, the MRIM has shown consistently that despite many environmental management requirements being met, major gaps remained and that these risks were escalating” (p. 16). That these remain the case at the MRM site highlights the need for further review of MRM operations together with the adequacy of the MRIM process.

More broadly, the IM should provide the community of Borroloola and the broader NT and Australian populations confidence that any environmental issues at MRM are being addressed in the best way possible. In our view this is not occurring effectively because:

1. The IM reports are commonly released to the public just before the end of year, in ways that limit the avenues for community response.

2. There is a long delay in the release of the IM report and the period of time that they cover – for example there is normally at least a year between the last point in time covered by the report and the release of the report. As of December 2020, there is no IM report covering past March 2018.

3. The IM Community Report is not presented in a form that encourages adequate public and community dialogue or addresses community concerns. We think that much more should be done to ensure ongoing and meaningful engagement with communities in Borroloola and surrounding districts in future IM reporting processes. To address these issues, we believe that it is crucial that the IM incorporate community concerns, expertise and observations of environmental impacts around the mine.

4. The IM relies on data released by MRM and therefore has limited information available on some of the potential environmental impacts.

5. There are too many opportunities for MRM to delay addressing the concerns raised by the IM.

6. The period for public consultation on Environmental Assessments (such as EISs) is too short, given amount of technical information and the remote location of the mine and the downstream community.

In the context of the evident mistrust between communities in Borroloola and surrounding districts, the mine operator, NT Government and the independent monitor [De Santolo 2018; Kerins and Green 2019] it is essential that the IM process be conducted in a timely fashion, in ways that are informed by a more systematic engagement with community concerns and priorities.
References


