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TECHNICAL MEMORANDUM

DATE	16 December 2022	**REF**	NSWDPE239613
TO	Ms Rose-Anne Hawkeswood – NSW Department of Planning and Environment	**REV**	0
FROM	Sophie Pape, Earth Systems Jeff Taylor, Earth Systems	**PROJECT**	Bowdens Silver Mine

INDEPENDENT REVIEW OUTCOMES – ACID AND METALLIFEROUS DRAINAGE

The New South Wales Department of Planning and Environment (NSWDPE) requested an independent review and advice in relation to acid and metalliferous drainage (AMD), water balance modelling and surface water management aspects of the proposed Bowden Silver Mine. Initial review findings relating to AMD were documented in a Memorandum dated 31 May 2022, with follow up advice on AMD risk classification and sampling provided on 9 September 2022. A response to Earth Systems' Memorandum dated 31 May 2022, was subsequently received in October 2022 (Corkery, 2022a).

Residual concerns of Earth Systems (2022a) documented on 23 November 2022, primarily relate to the need for a reliable method for classifying and segregating mine wastes as potentially acid forming (PAF) or non acid forming (NAF), and the need to modify the waste rock dump (and TSF) AMD management strategy / closure design to avoid the post closure risk of water treatment in perpetuity. A series of potential conditions for NSWDPE approval were also documented on 23 November 2022 to address these key residual concerns (Earth Systems, 2022a). These potential conditions have largely been accepted by Bowdens Silver, in their response dated 1 December 2022 (Corkery, 2022b).

An exception to this relates to Earth Systems' recommendation to conduct static geochemistry test work on at least 1 representative sample per 10,000 tonnes of waste rock material. This is broadly consistent with Leading Practice guidelines (DIIS, 2016), indicating up to several hundred samples at the pre-feasibility stage, and noting the substantial waste rock tonnages in question (6.3 million tonnes) and that the project has progressed beyond pre-feasibility. It should also be clarified that it is not guaranteed that a suitable AMD risk classification system can be developed based on Total Sulfur, and that alternative approaches may need to be considered. Hence, this work should be completed prior to mining as per the suggested condition.

Regarding management of long term AMD risk from the PAF waste rock dump and TSF, it remains our advice that the design of these facilities will need to be updated, noting that GCL liners have a limited design life, store-and-release covers are not suitable for AMD control, and the longevity of AMD generation from PAF waste rock is unknown but may continue for hundreds of years. These factors will need to be considered in future test work.

Pit water quality could be affected by AMD and if so can be expected to progressively deteriorate in the long term post closure. An understanding of water quality impacts associated with the risk of throughflow to Hawkins Creek, with and without mitigation, is warranted and this is the subject of a separate review (Earth Systems, 2022b).

There were 5 additional recommendations documented by Earth Systems (2022a) and as these were not specifically addressed by Corkery (2022b) but relatively straight-forward, it is assumed that they are generally accepted by Bowdens Silver.

There remain some apparent areas of misunderstanding in the responses provided and a more detailed response or clarification can be documented upon request, but this is not expected to affect the outcomes summarised above.

Therefore, based on the acceptance of Earth Systems' suggested conditions by Bowdens Silver and including specific consideration of the residual concerns noted above, no further recommendations relating to AMD are provided at this stage.

REFERENCES

Corkery (2022a). *Response to Earth Systems Review – Acid and Metalliferous Drainage*. Consultants report prepared by R. W. Corkery & Co. Pty Ltd. October 2022.

Corkery (2022b). *Bowdens Silver Project: AMD Independent Review Outcomes*. Consultants report prepared by R. W. Corkery & Co. Pty Ltd. October 2022.

DIIS (2016). *Preventing Acid and Metalliferous Drainage*. Leading Practice for Sustainable Development Program for the Mining Industry. Australian Government. Department of Industry, Innovation and Science. September 2016.

Earth Systems (2022a). *Update on Independent Review – Acid and Metalliferous Drainage. Bowdens Silver Mine*. Technical memorandum prepared for the New South Wales Department of Planning and Environment (NSWDPE).

Earth Systems (2022b). *Update on Independent Review – Water Balance Modelling and Surface Water Management. Bowdens Silver Mine*. Technical memorandum prepared for the New South Wales Department of Planning and Environment (NSWDPE).