COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

May 26, 2020

Richard Mittasch
Calais Resources Colorado, Inc.
P.O. Box 3395
Nederland, CO 80466

RE: Cross Gold Mine, Permit No. M-1977-410, Technical Revision No. 5 (TR-05), Preliminary Adequacy Review

Mr. Mittasch:

On April 29, 2020, the Division of Reclamation, Mining and Safety (Division) received your Technical Revision application (TR-05) for the Cross Gold Mine, addressing the following:

> *To provide for rehabilitation of the Idaho Tunnel portal to provide safe entry into the mine and allow the flow of mine water to be re-established in order to meet permit discharge requirements. Rehabilitation of the tunnel portal will require associated surface waste rock storage, and steel rail and timber disposal. All other aspects of the mining operation will remain the same.*

After reviewing the materials submitted, the Division has identified the following adequacy items that must be addressed before an approval of TR-05 can be issued:

1) Please address all adequacy concerns identified in the enclosed Memorandum from Jeff Graves, DRMS.

2) Given the potential for offsite damage and impacts to Caribou Road from any further destabilization of the collapsed portion of the Idaho Tunnel (including the void), the Division considers the collapse repair to be a high priority project requiring implementation as soon as reasonably possible (after TR-05 approval). Therefore, please provide a proposed schedule for implementation of this project.

3) If you do not currently have enough information to address adequacy items pertaining to the tunnel rehabilitation project, please commit to providing this information in a subsequent Technical Revision prior to implementation.

This completes the Division's preliminary adequacy review of the materials submitted for TR-05. The decision date for TR-05 is currently set for **May 29, 2020**. If additional time is needed to address the adequacy items, an extension request must be received by our office prior to the decision date.

If you have any questions, you may contact me by telephone at (303) 866-3567, ext. 8129, or by email at amy.eschberger@state.co.us.

Sincerely,

Amy Eschberger
Environmental Protection Specialist

Encl: Memorandum from Jeff Graves, DRMS, dated May 20, 2020

Cc: Jeff Graves, DRMS
Peter Hays, DRMS
Michael Cunningham, DRMS

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MEMORANDUM

Date: May 20, 2020

To: Amy Eschberger; Division of Reclamation, Mining and Safety

From: Jeff Graves; Division of Reclamation, Mining and Safety

RE: Cross Gold Mine; Permit No. M-1977-410; Review of TR-5 and TR-7 - Specifically Pertaining to Underground Rehabilitation

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I have read through both TR-5 and TR-7 and have a reasonable understanding of the Idaho Tunnel rehabilitation work as proposed by Calais Resources Colorado, Inc. My comments and questions pertain to the proposed underground rehab, and not slope stability as I believe that is best addressed by the Minerals Program. I am also not sure exactly what oversite the Minerals Program has over specific underground rehabilitation requirements or design criteria, so disregard anything that is beyond scope of your jurisdiction.

Current Conditions and Proposed Action

My understanding of TR-5 and TR-7 is that the operator is proposing to stabilize a recent collapse inby the portal in addition to rehabilitating some length of the "tunnel" to provide access to the underground workings and facilitate unimpeded discharge of mine water from the portal. The operator describes a recent collapse just inby the portal on the Idaho Tunnel that has resulted in a significant void that has migrated vertically to surface as indicated in Figure 4, TR-5. The operator also describes another location of collapse debris approximately 200 ft inby the portal that is resulting in a 2-3 ft depth of impounded water beyond that point.

The design notes provided in TR-5 indicate that at least four steel sets and lagging have been installed near the portal collapse to provide stability near the entry. Additionally, ground support further inby is described as consisting of fully lagged timber sets for 41 ft, followed by rock bolts and mesh (chain link) to approximately 200 ft. Beyond that point, the drift is described as being unsupported.

The operator proposes to mitigate the void resulting from the collapse by filling the void with cellular concrete. Additional steel sets equivalent to the currently installed sets will be utilized in other areas of significant instability. A long list of other ground support methodologies is provided in TR-5 as possible options for supporting unstable ground as tunnel rehabilitation proceeds.

Evaluation of Proposed Action

The operator's desire to utilize cellular concrete to fill the collapsed void is an appropriate application for that construction material. Cellular concrete has a number of advantages for use as void fill in this situation as highlighted by the applicant. The lower density, higher compressive strength and permeability as

compared to the surrounding soil or alternative void fill material like polyurethane foam, suggest that cellular concrete is an acceptable alternative. The challenge with utilizing cellular concrete in this application is the connectivity of the void space being addressed. TR-5, Figure 4, appears to indicate what could only be described as an idealized void completely open from the surface to the steel sets along the drift. TR-5 also mentions a Figure 5 that is supposed to depict the collapse/void as a transverse cross section, but does not appear to be included in TR-5. If the void space is not as continuous as described or pictured in Figure 4, then the cellular concrete will not completely encapsulate the steel sets as designed, requiring additional void filling with a pumped material from the drift elevation to achieve the intended design. For steel sets to provide adequate passive stabilization of overburden material, there cannot be void space between the sets and overlying material.

The current and proposed steel set design is W6x28 sets on four foot centers with 3" x 8" Douglas Fir lagging. The operator did not provide any load design criteria by which to determine the adequacy of the proposed sets. Additionally, the W6x28 steel beams are a completely non-standard beam size that may or may not even exist. W6 steel beams typically come in weights of 20 or 25 lbs/ft not 28. There is a common 8" beam size in 28 lbs/ft, but not a 6" beam. There is a significant difference in the section modulus associated with those varying beam sizes that is critical to evaluating the sufficiency for the proposed design. The applicant should verify the beam size for steel sets.

The designer should also specify the steel type associated with any steel applications, as this is another critical aspect in evaluating the sufficiency of a proposed design. The most common steel type for W shapes is A36 (36ksi yield strength), but other steel types of higher yield strength could be specified to allow for smaller section moduli with equivalent capacity.

Photograph 4 in TR-5 depicts frozen inflows along the Idaho Tunnel. Inflows that continually freeze during winter months can put large lateral loads on steel sets causing them to displace at the feet if not adequately restrained. The applicant did not provide any detail of connection at the steel set footing to adequately demonstrate that the posts are laterally constrained.

Finally, design life should be provided as an evaluation criteria for any implemented ground control measures. Considering the potential for impact to a public structure (adjacent road), design life should be adequate to ensure long term protection of the structure. A higher design life will likely necessitate the consideration of steel corrosion, timber degradation and other life of design concerns that may dictate up size of load bearing elements. Absent the information described above it is impossible to evaluate the adequacy of the proposed steel set design, but the proposed design does not appear sufficiently conservative based on previous experience with projects of a similar nature.

The applicant proposed the use of the Q-system of rock mass classification for determining the appropriate ground support methodology, and when applied correctly should result in an adequate design. All rock mass classification systems rely on some level of generalization that must be applied to site specific conditions often dictating a more conservative approach than the system would prescribe.